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(54) Abstract Title: **Game machine**

- (57) A game machine, particularly an arcade game machine, has a modular construction including provision for electrically detaching the player control(s) unit from the processing control device contained within the main body of the machine to allow replacement or exchange of the player controls, eg for different types of game, (Fig 5, not shown) and wherein the processing control device accommodates replaceable game software memories to allow a service engineer to readily exchange both the game and the operational controls. The processing control device may be contained in a casing 45 such that the display controller, a game memory and a central control unit are each configured as circuit modules in cartridge form with connectors 39a,, b, c in recesses 41a, b, c establishing electrical contact with similar connectors in cartridges 64a, b, c (Fig 3, not shown); lateral finger recesses 47a, b, c assist in easy removal of the cartridges.

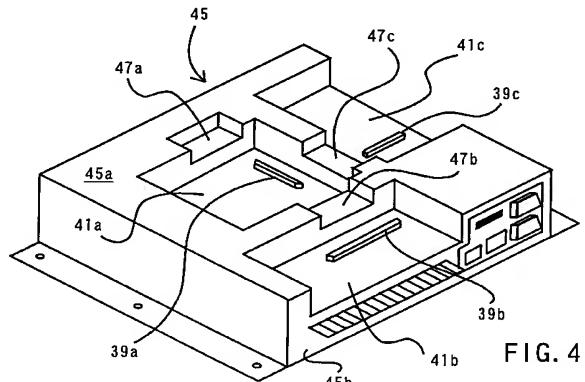


FIG. 4

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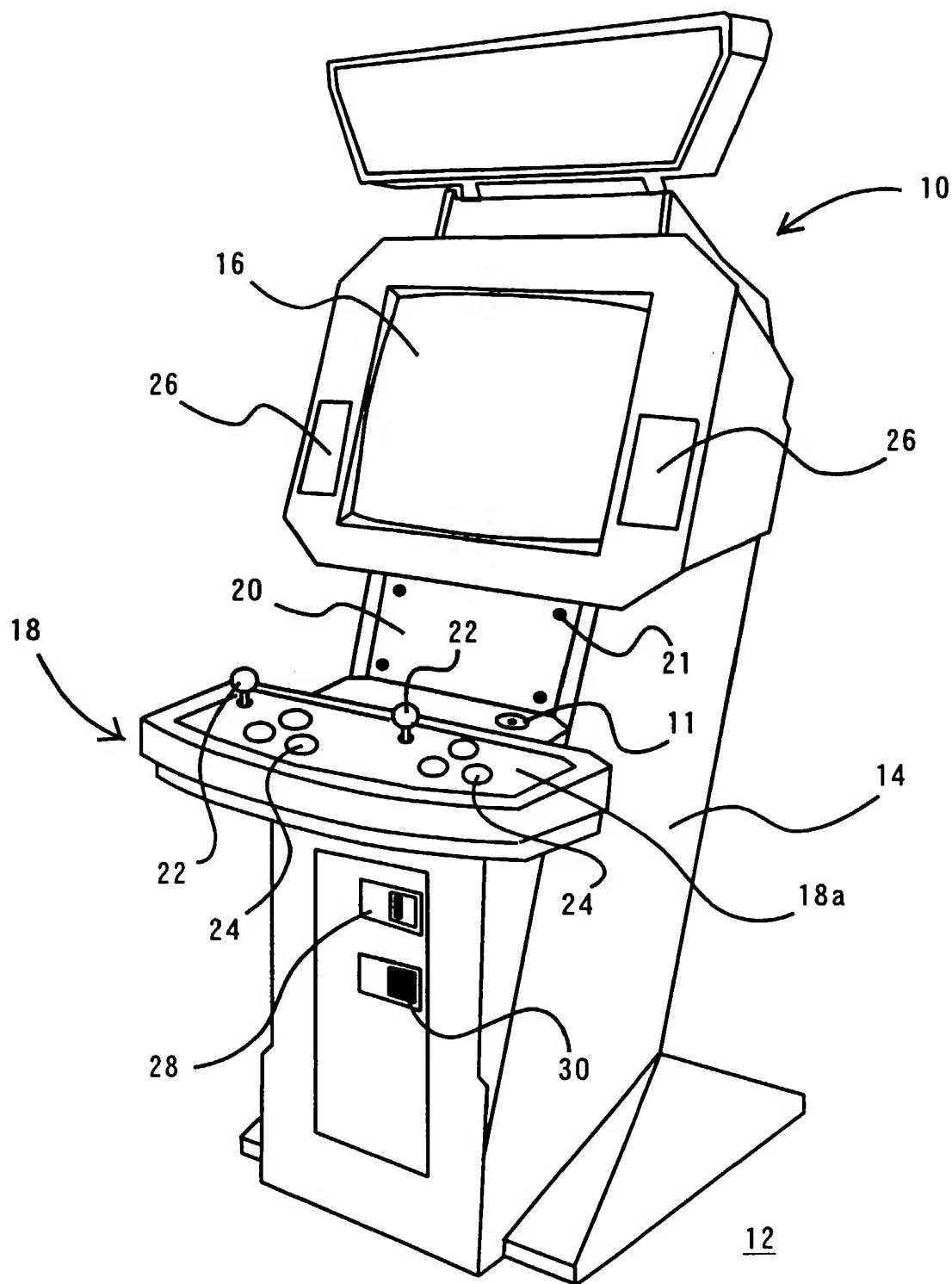


FIG. 1

FIG. 2

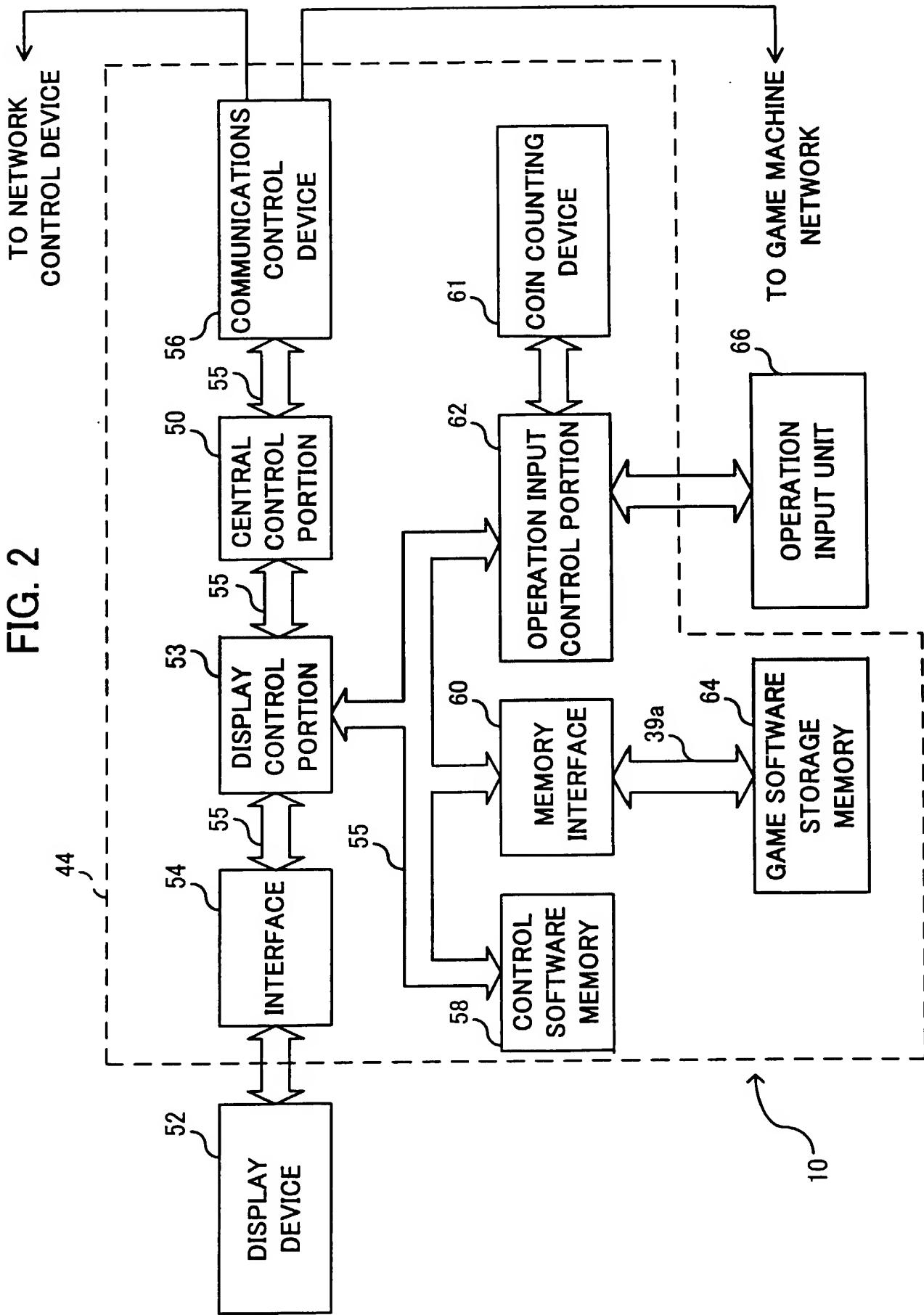


FIG. 3

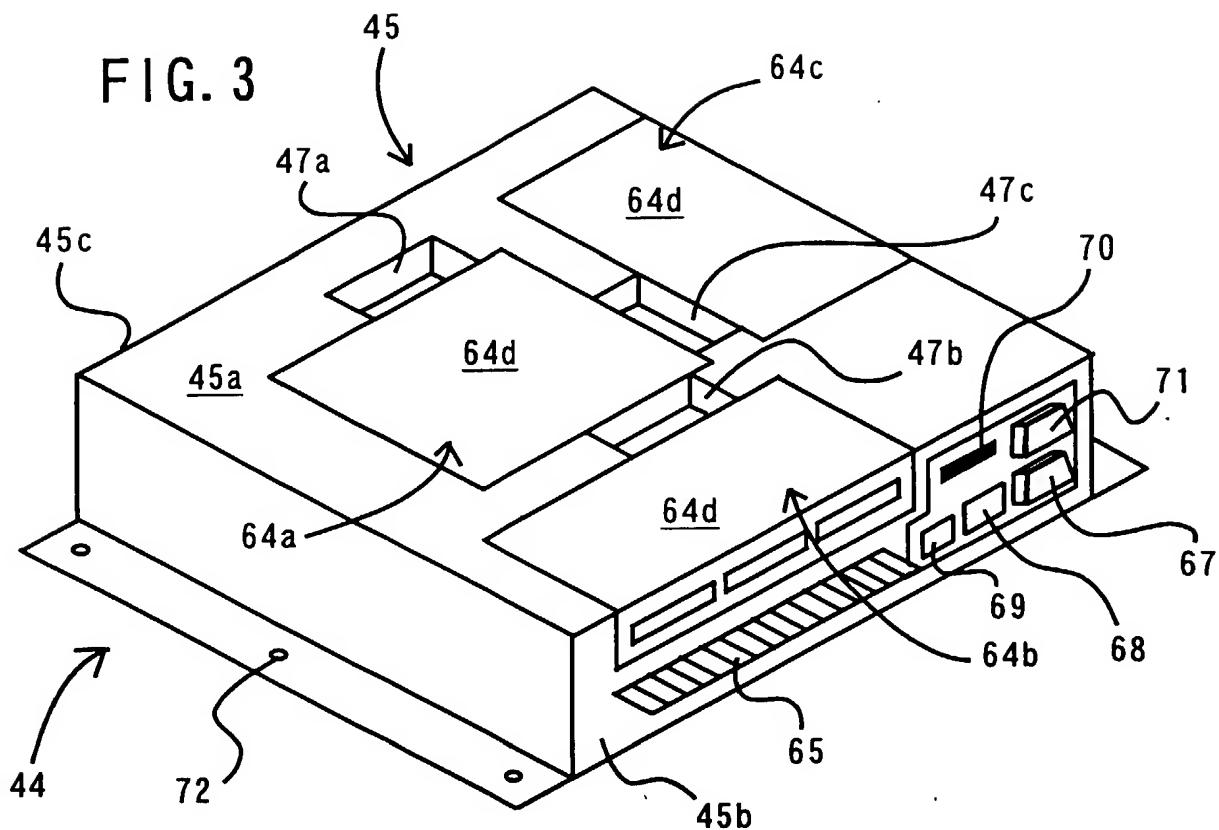
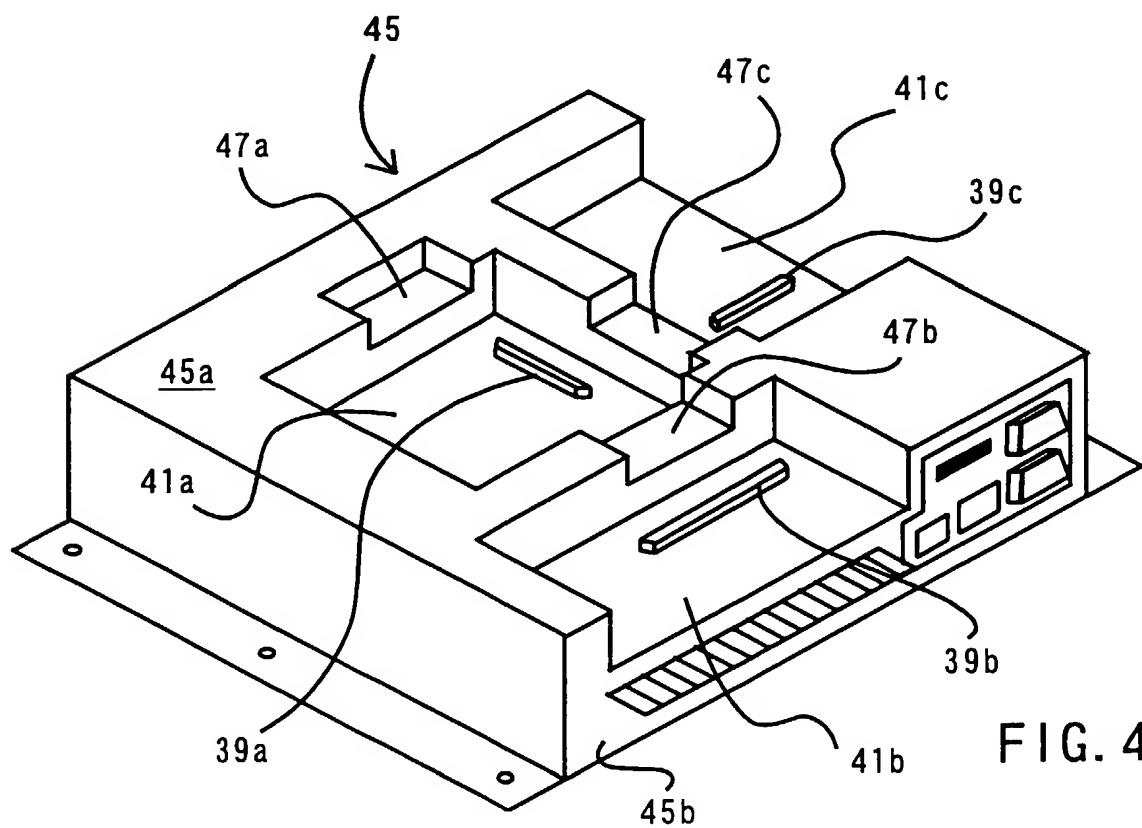


FIG. 4



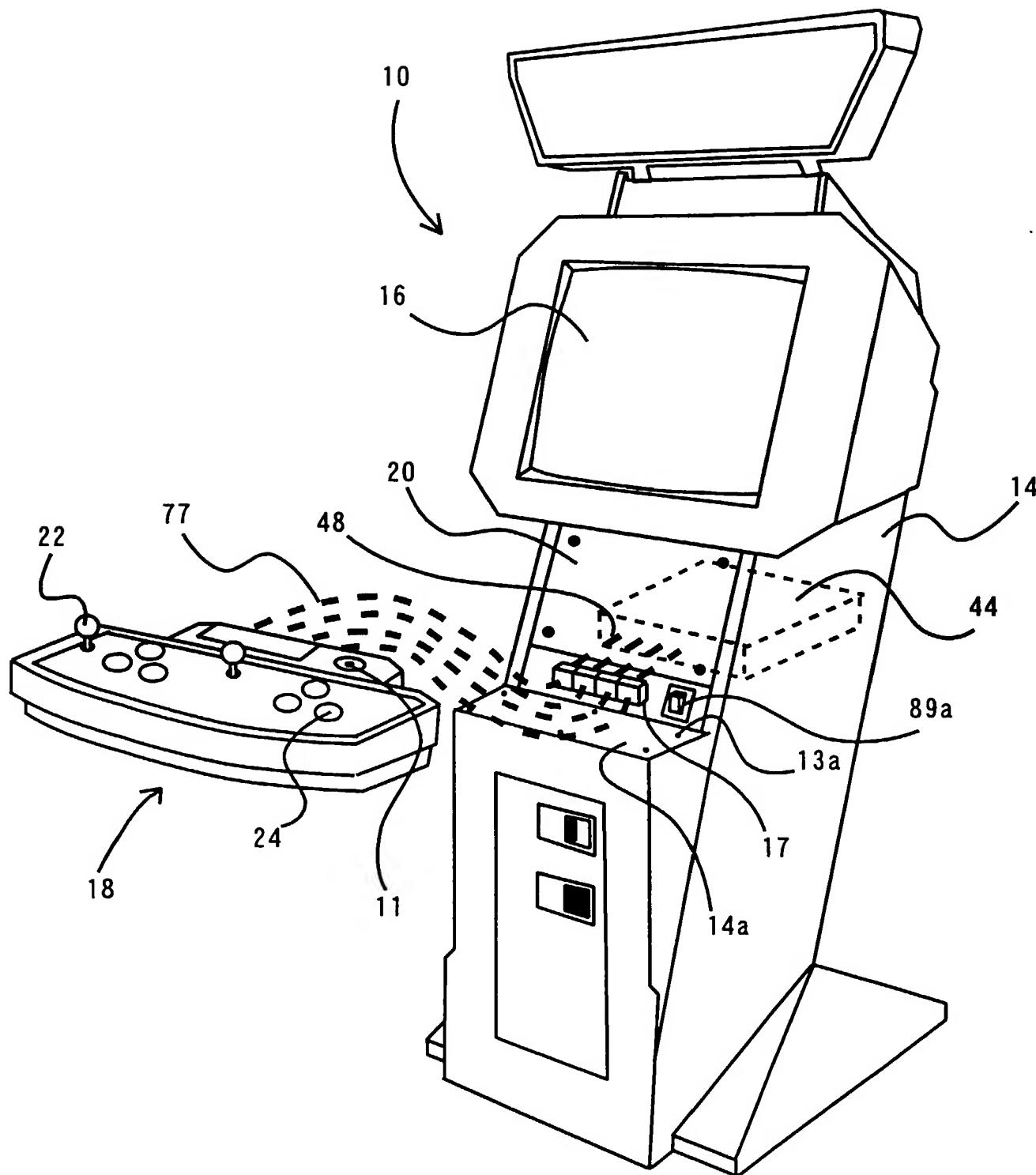


FIG. 5

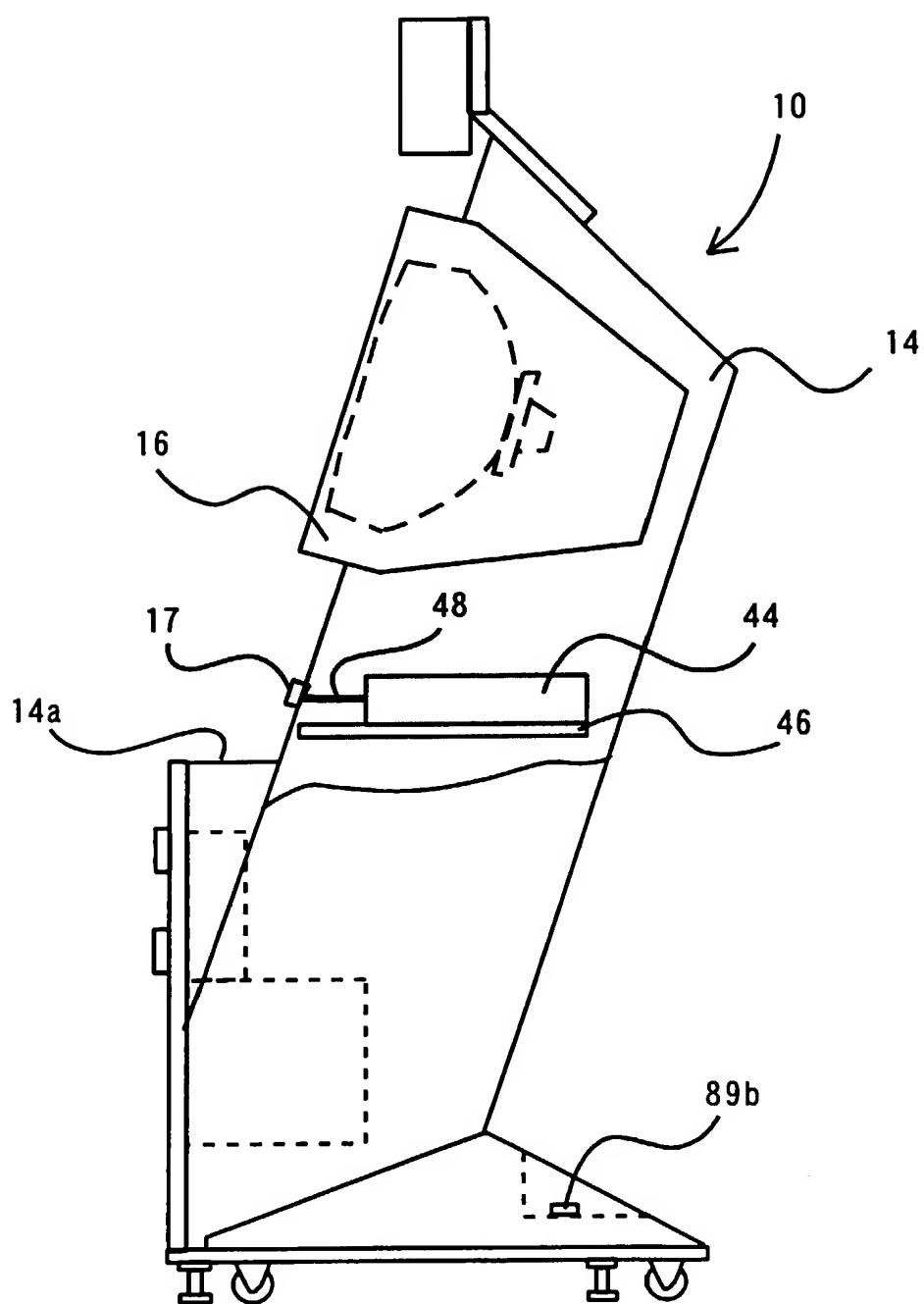


FIG. 6

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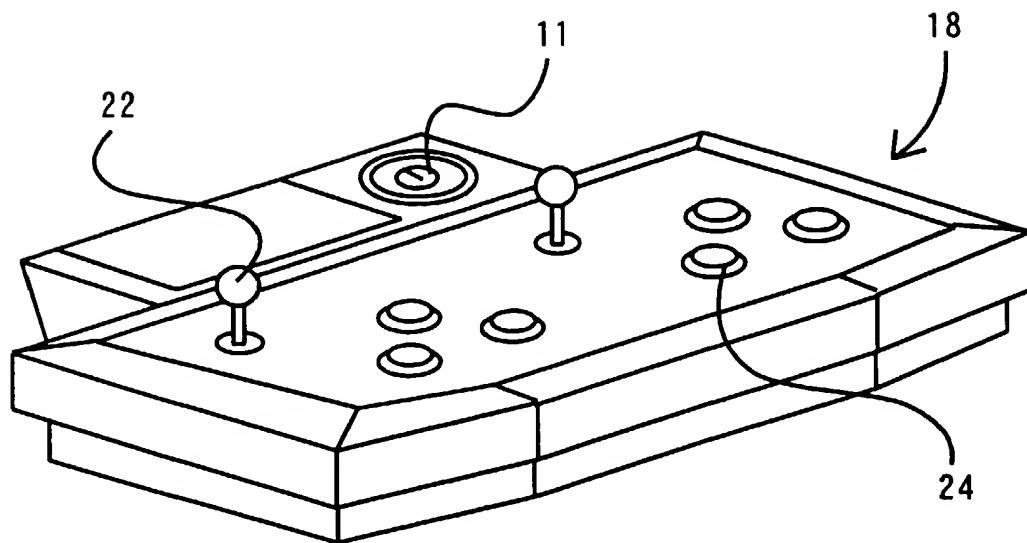


FIG. 7

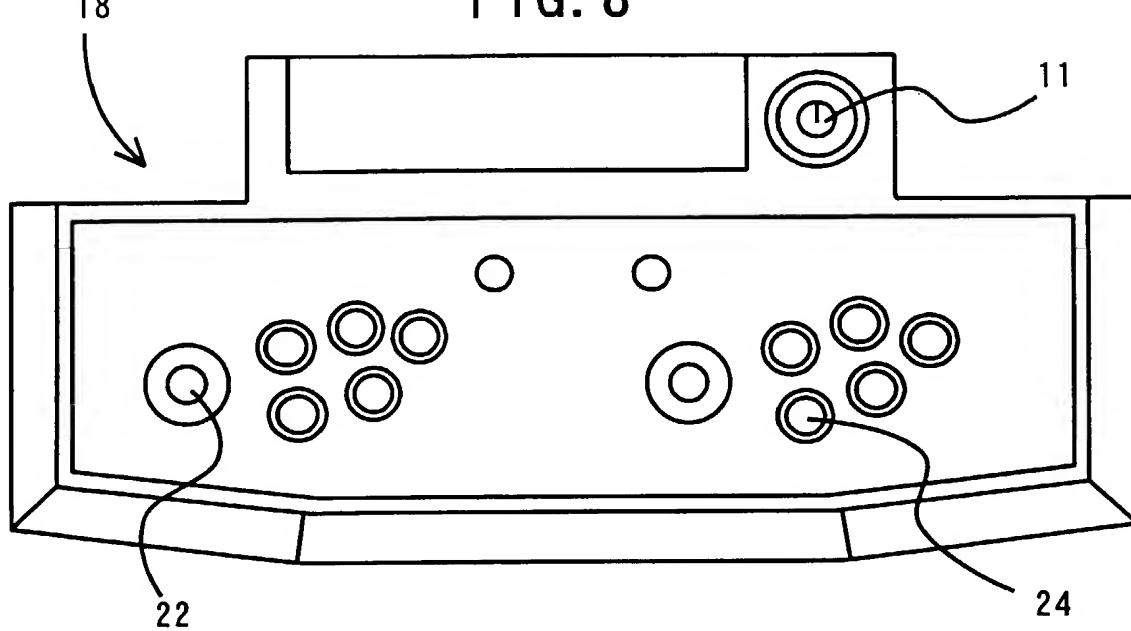
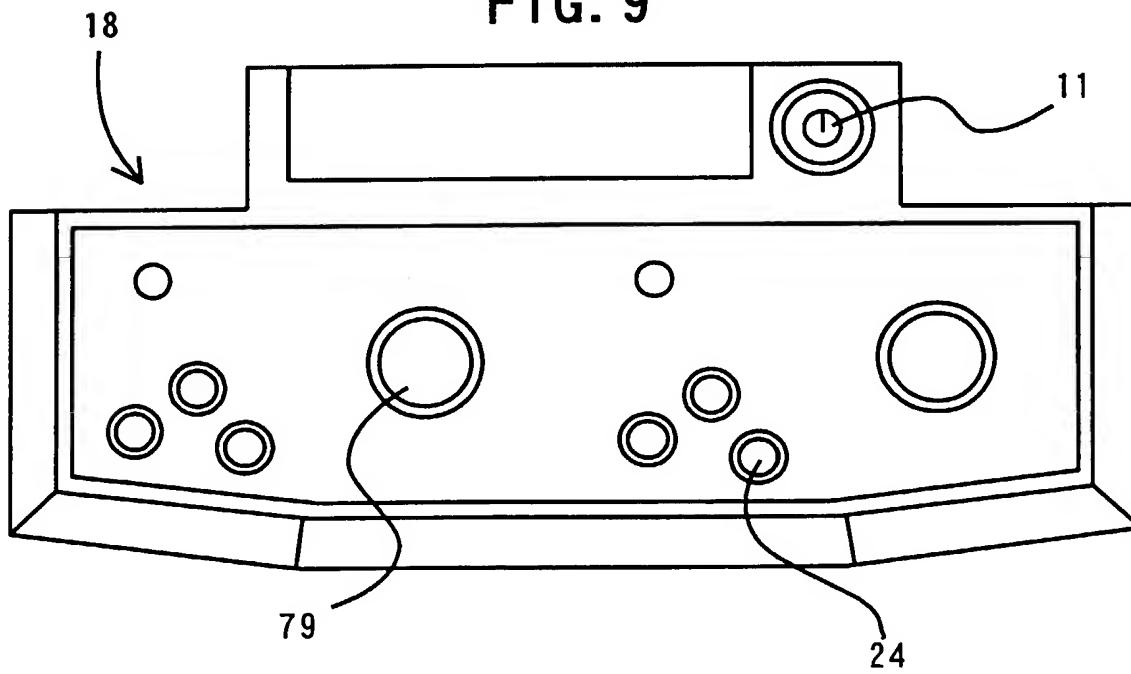
FIG. 8**FIG. 9**

FIG. 10

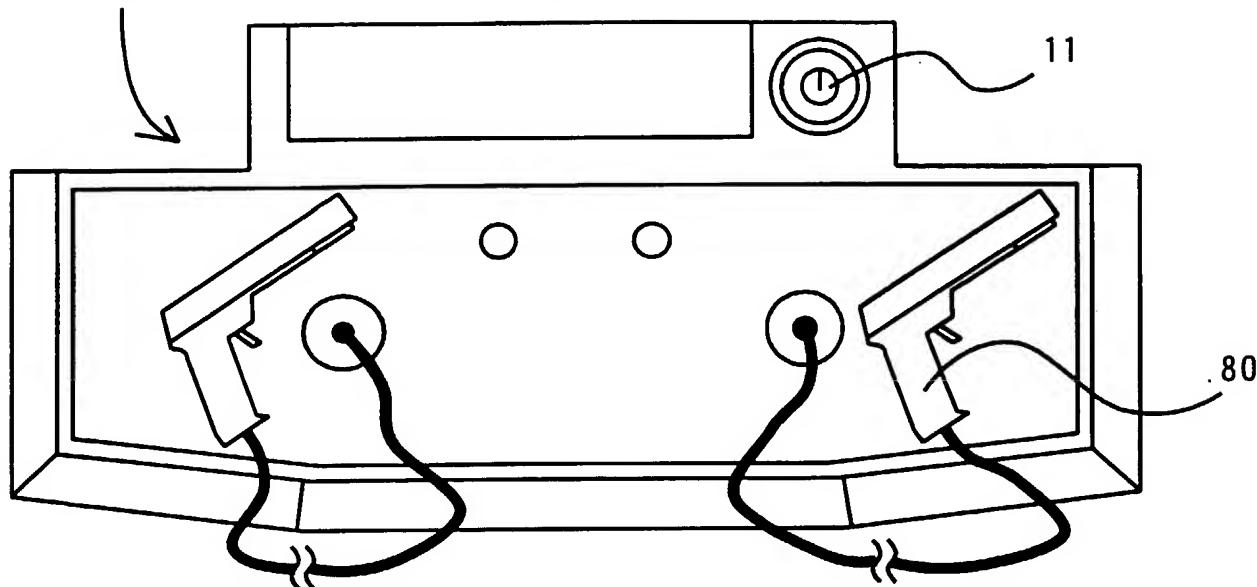
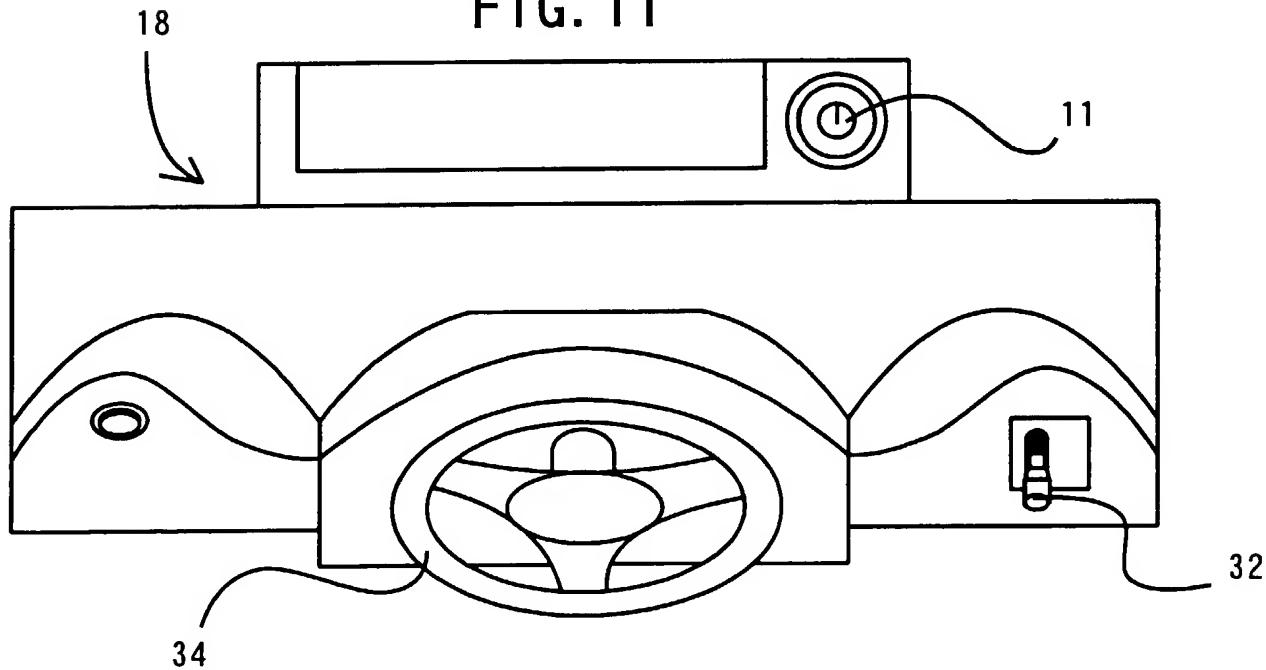


FIG. 11



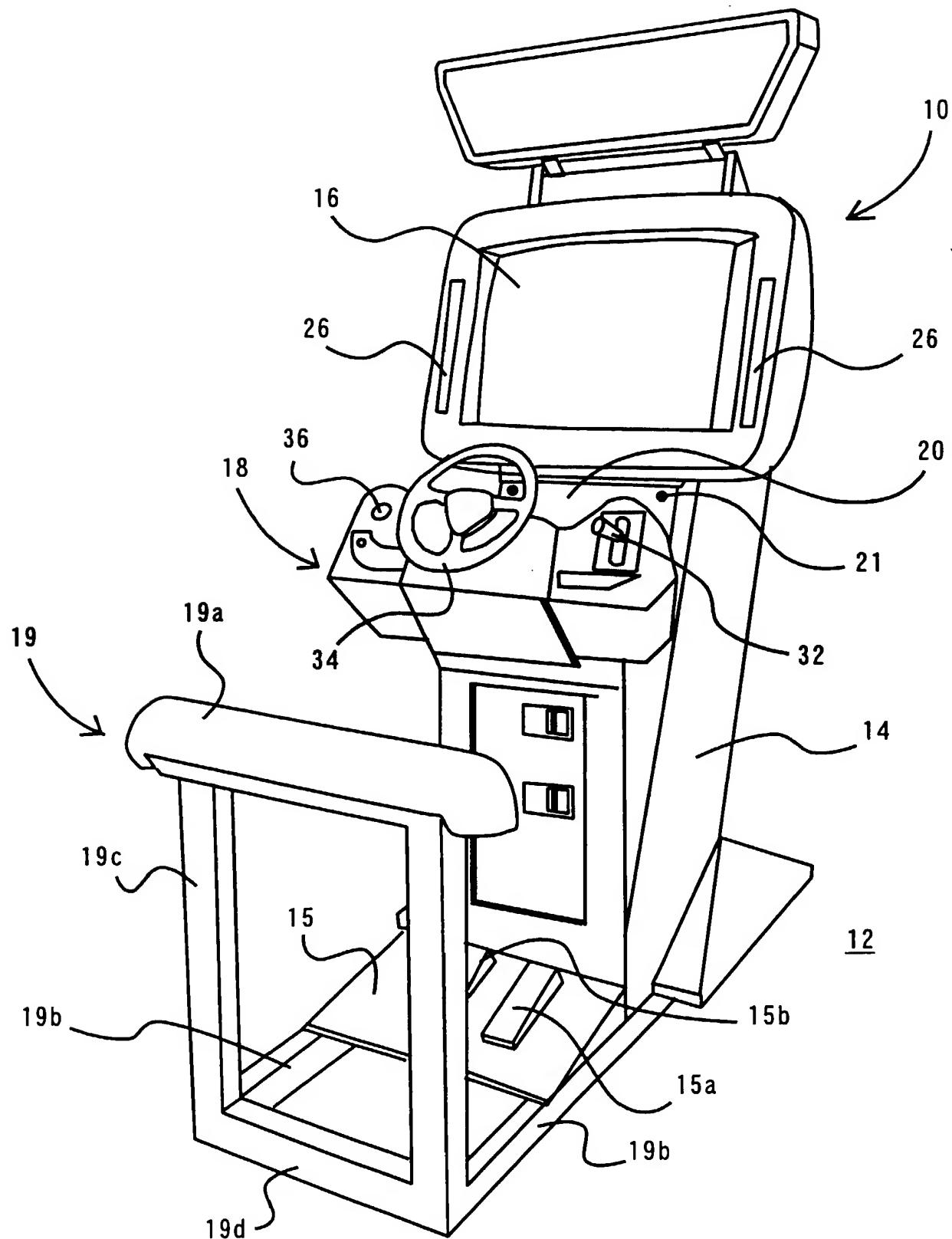


FIG. 12

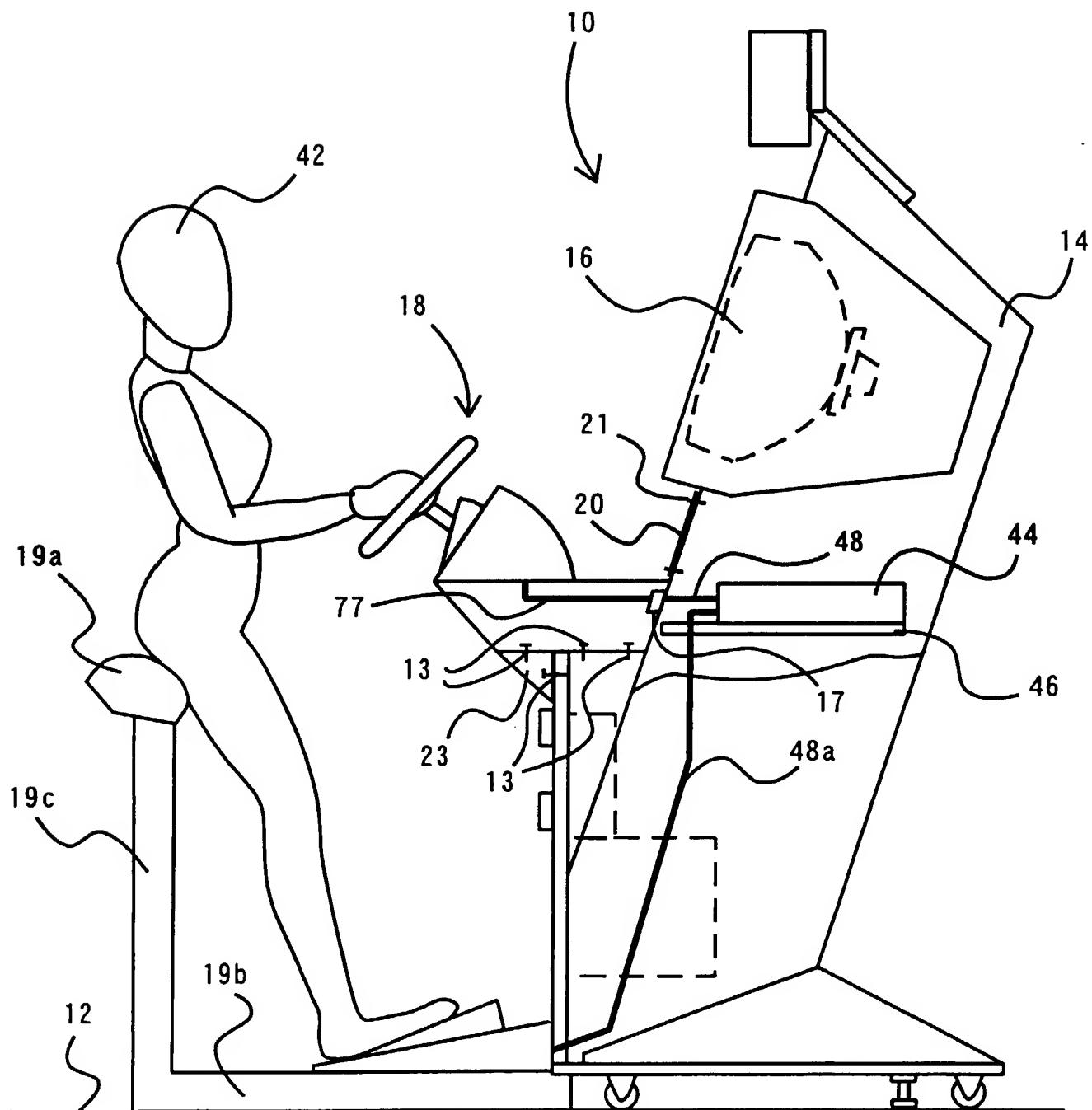


FIG. 13

FIG. 14

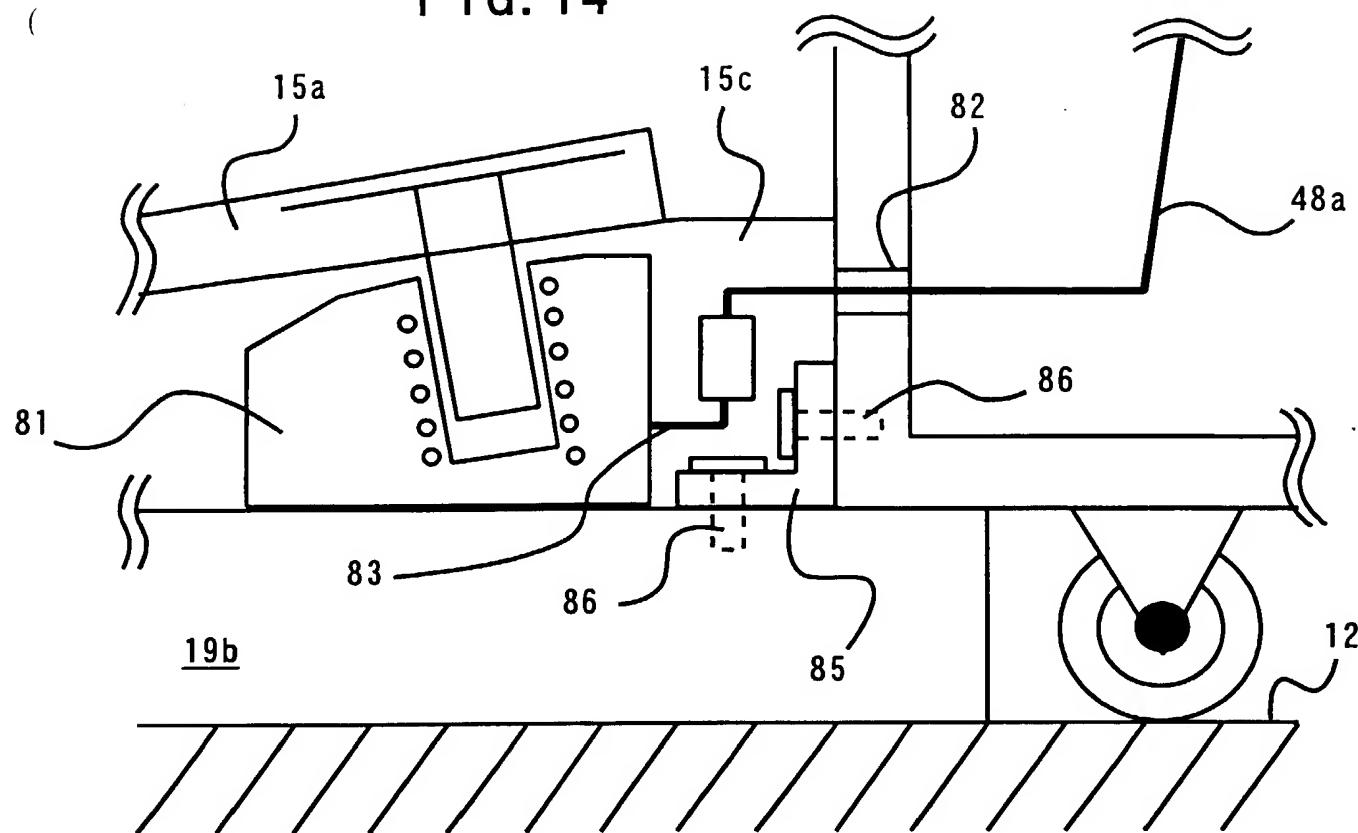
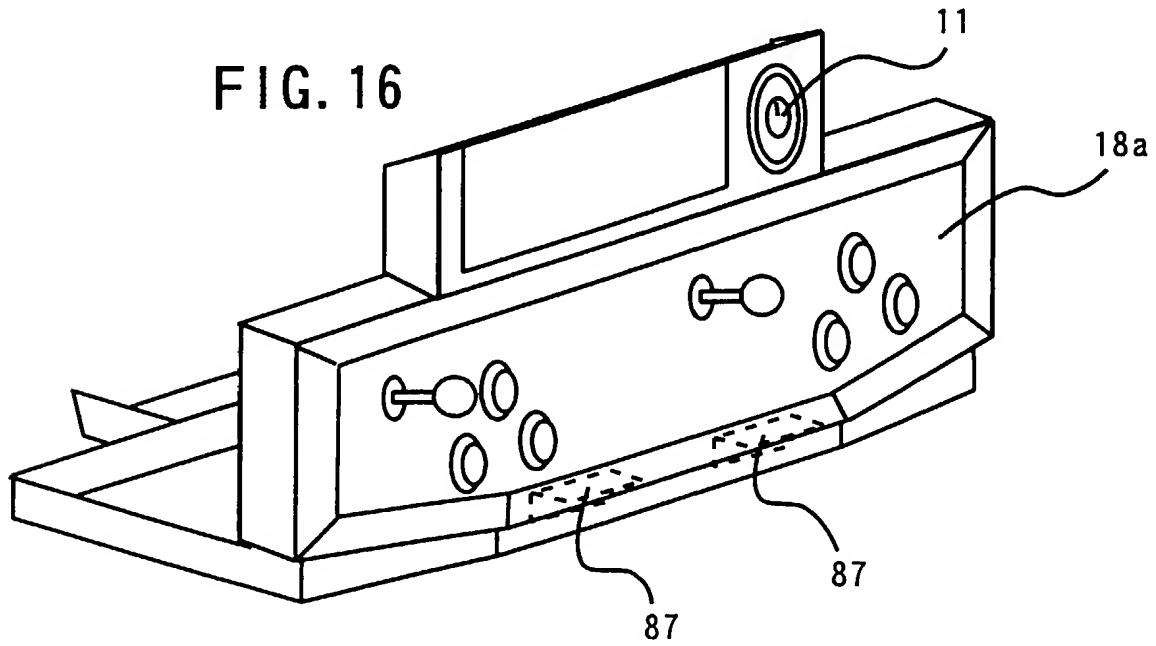


FIG. 16



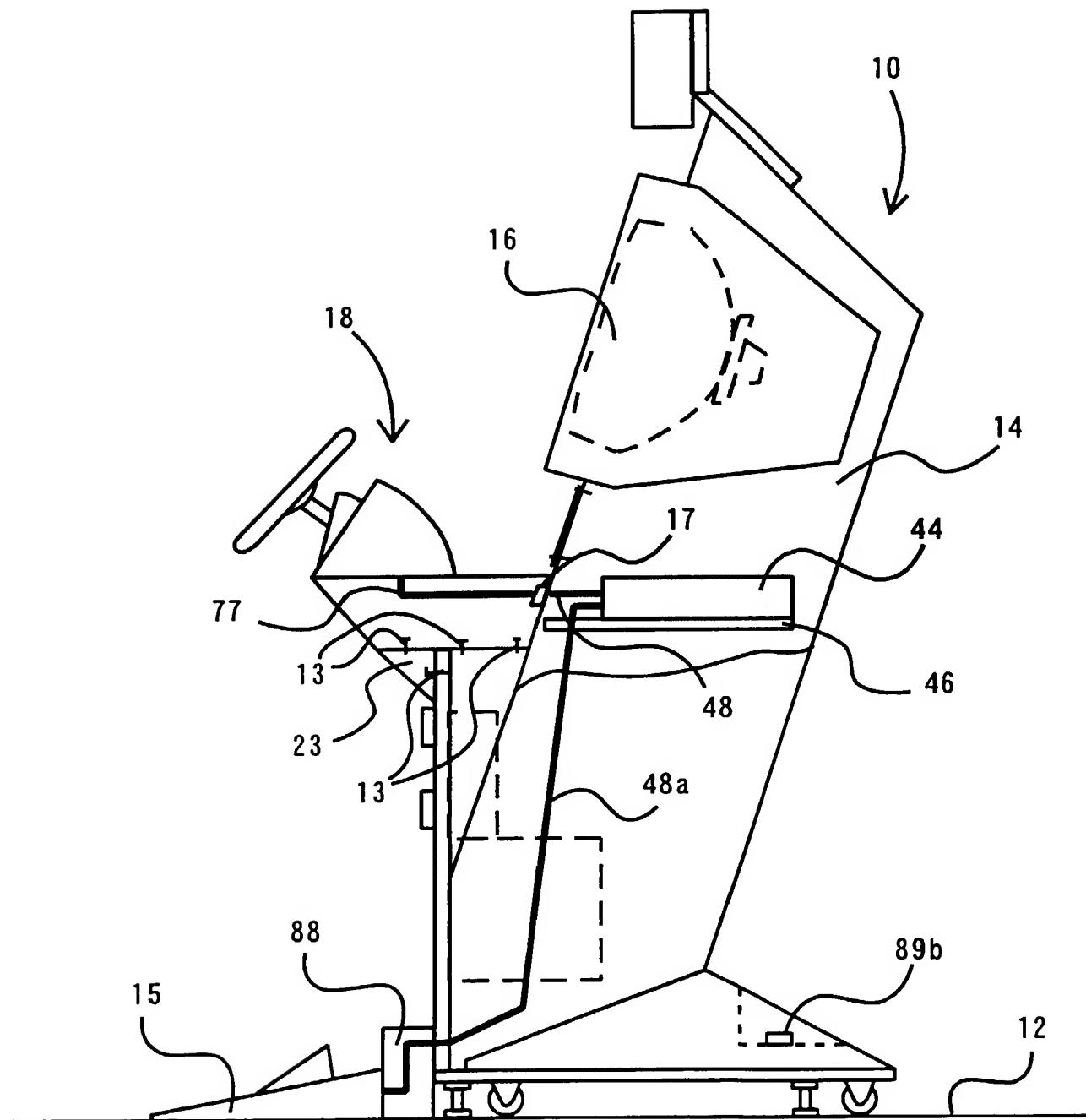


FIG. 15

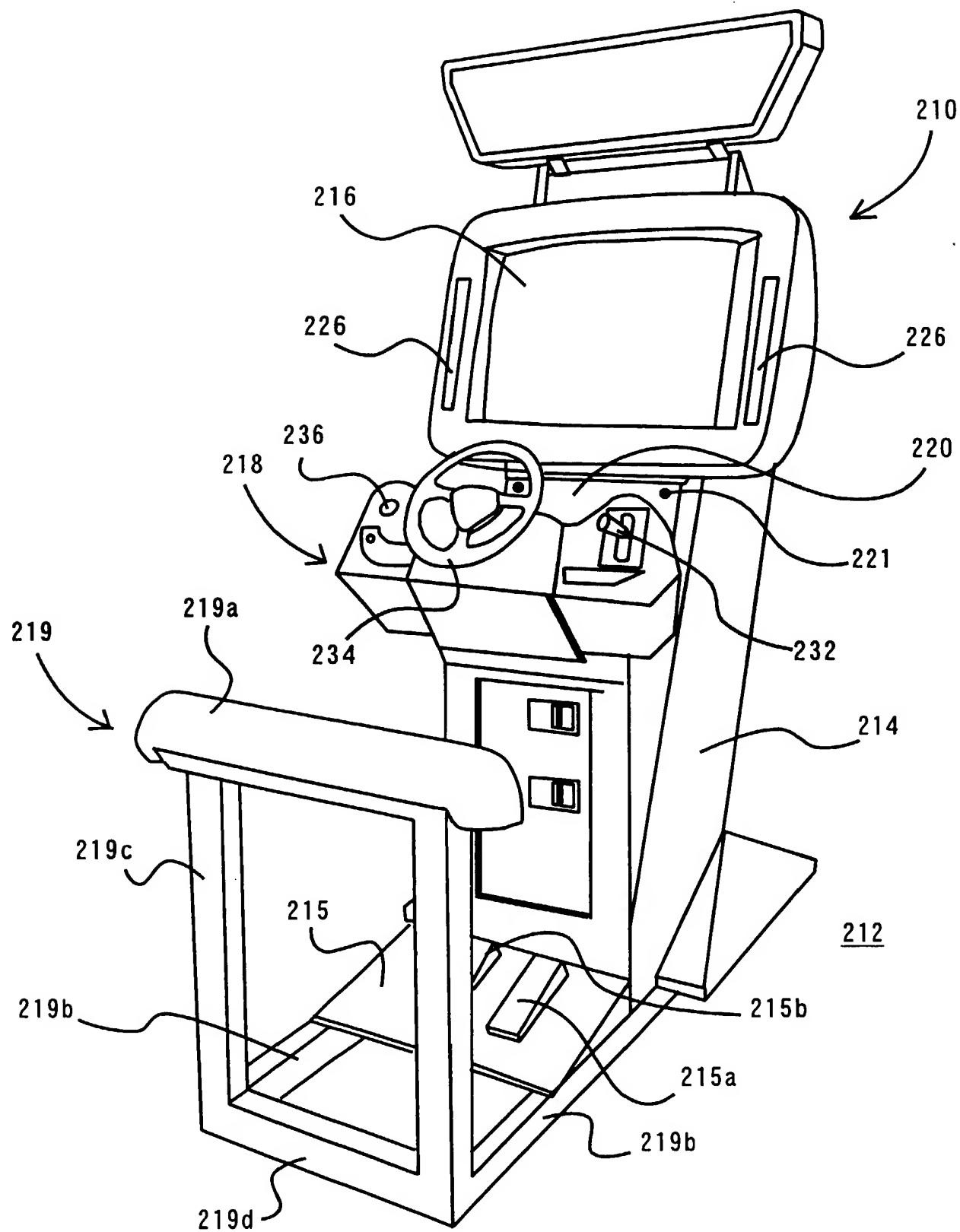


FIG. 17

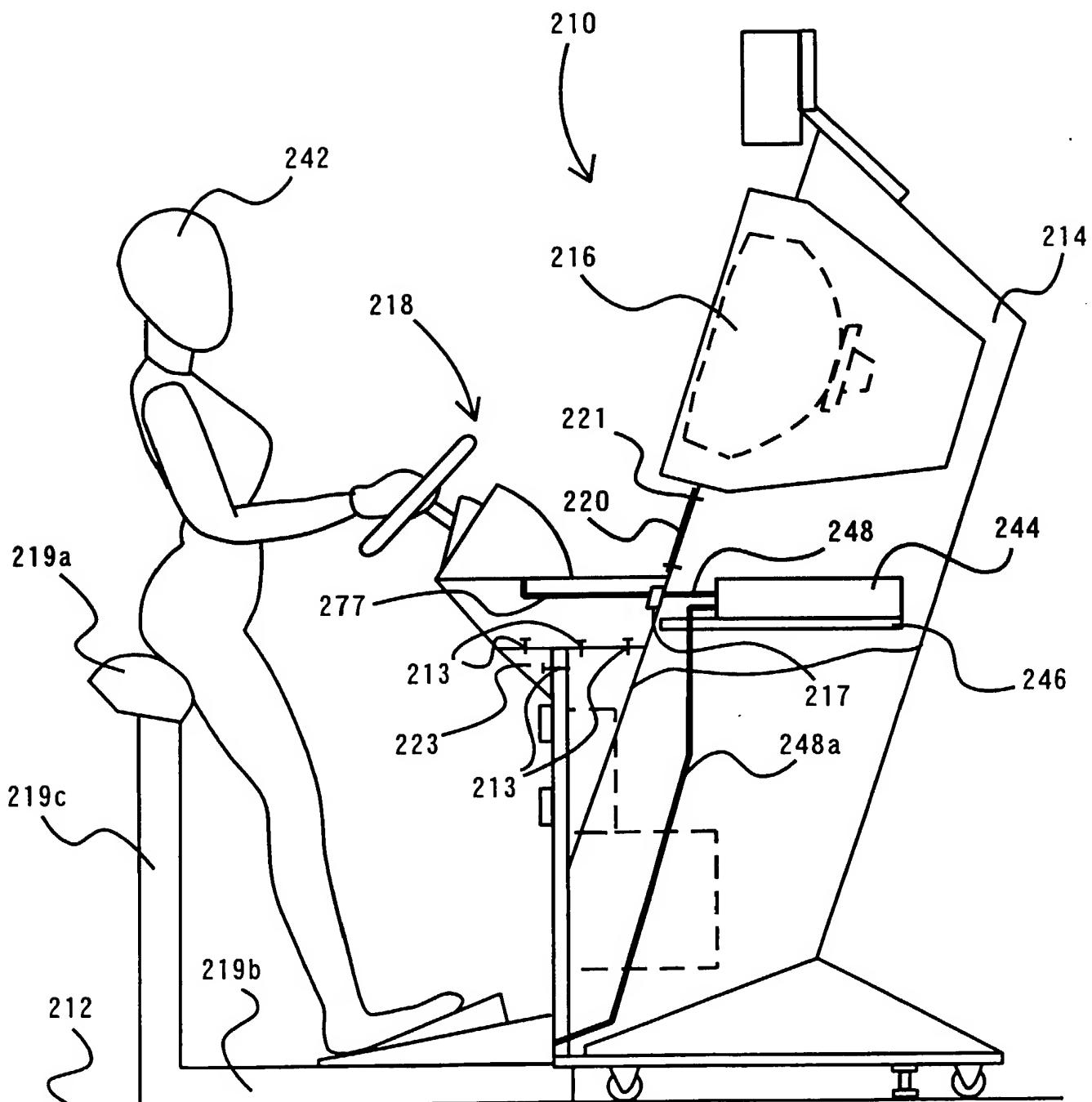


FIG. 18

FIG. 19

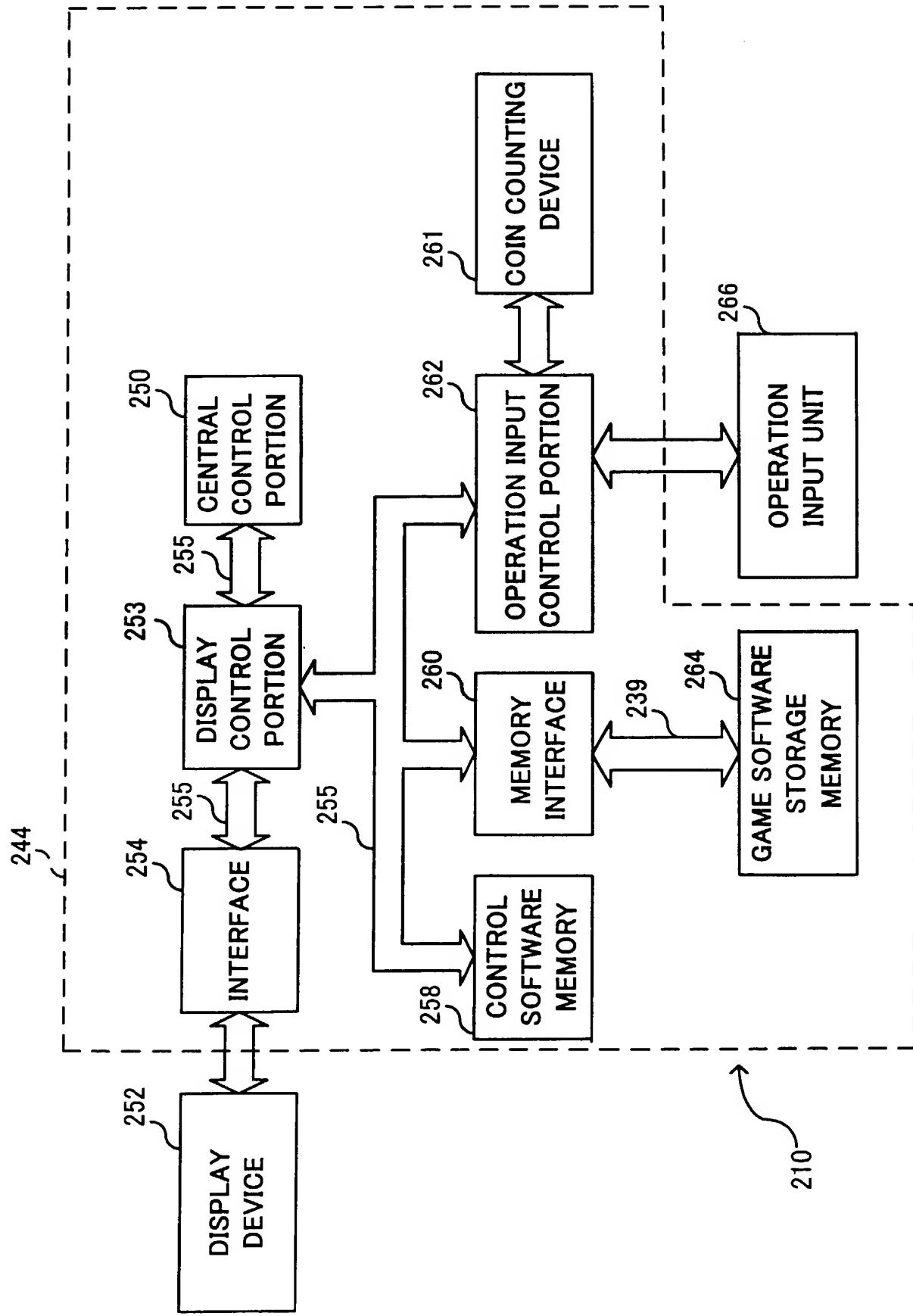


FIG. 20

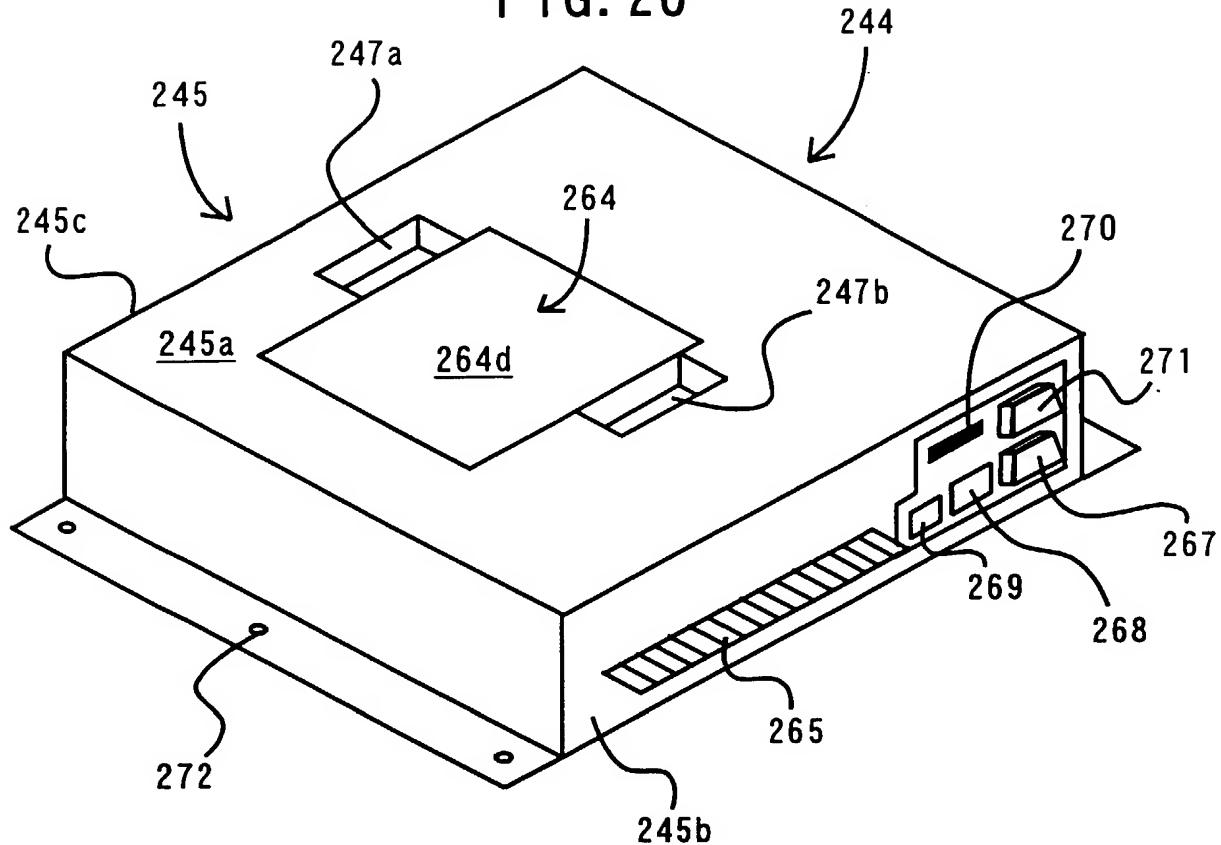
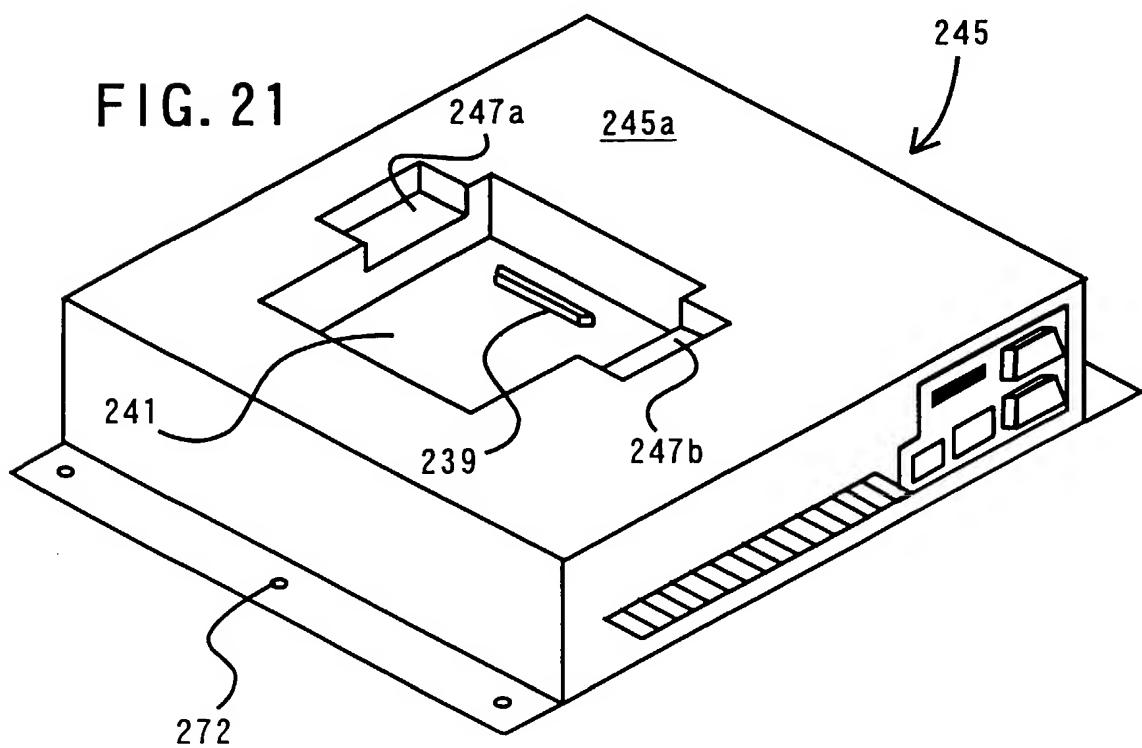


FIG. 21



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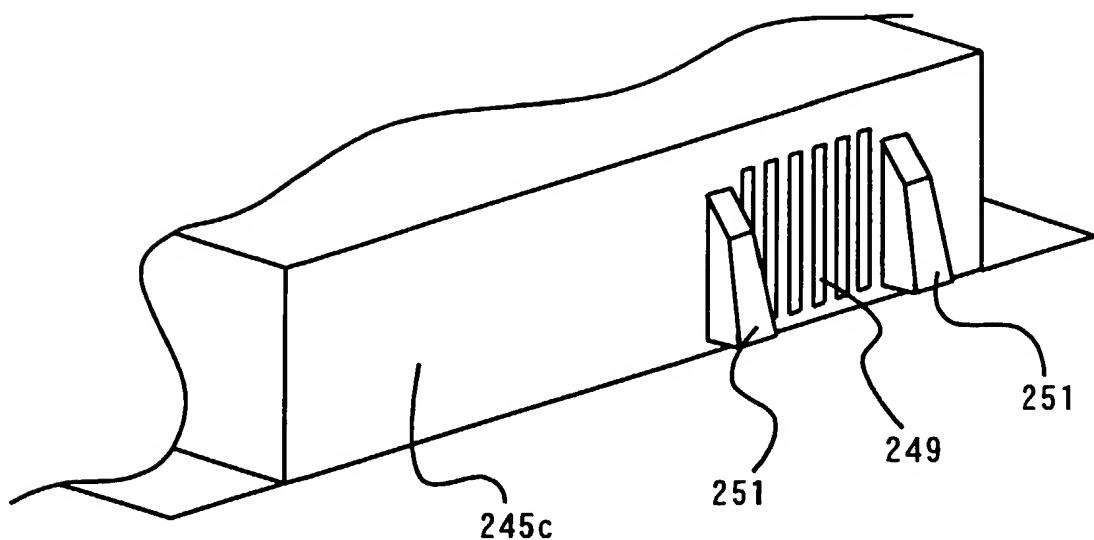


FIG. 22

FIG. 23

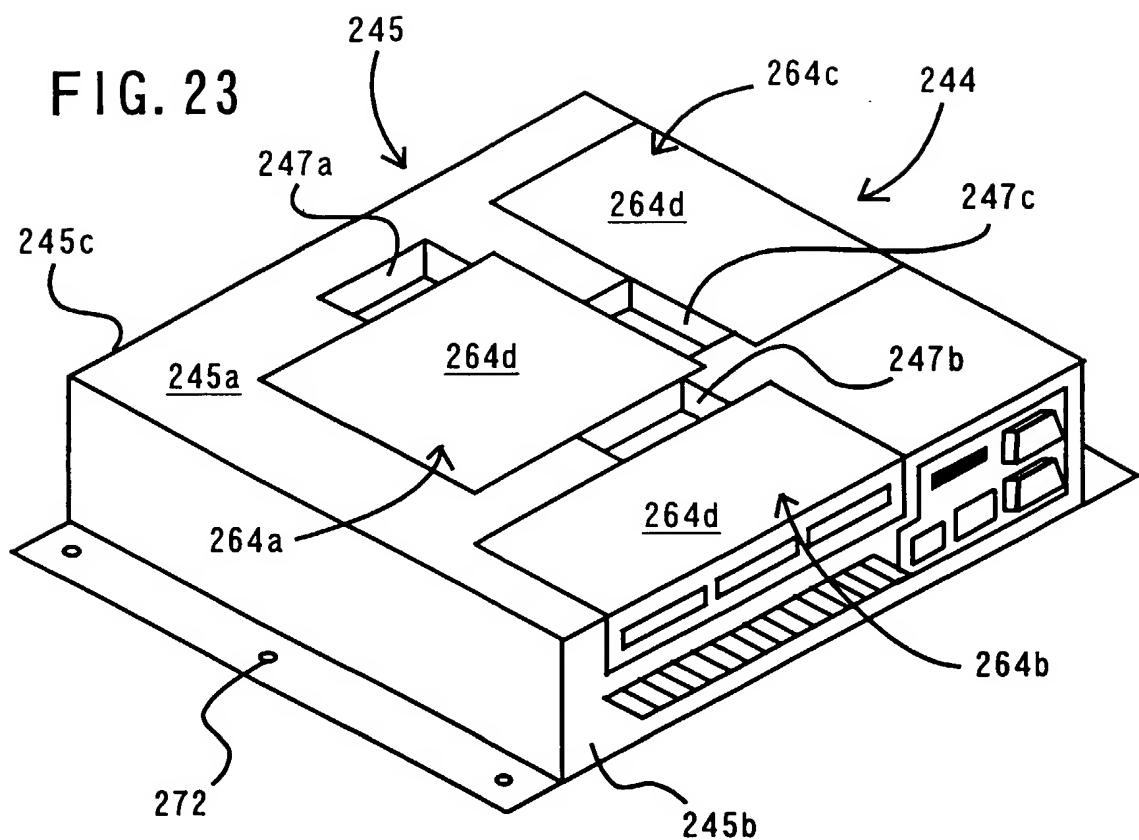
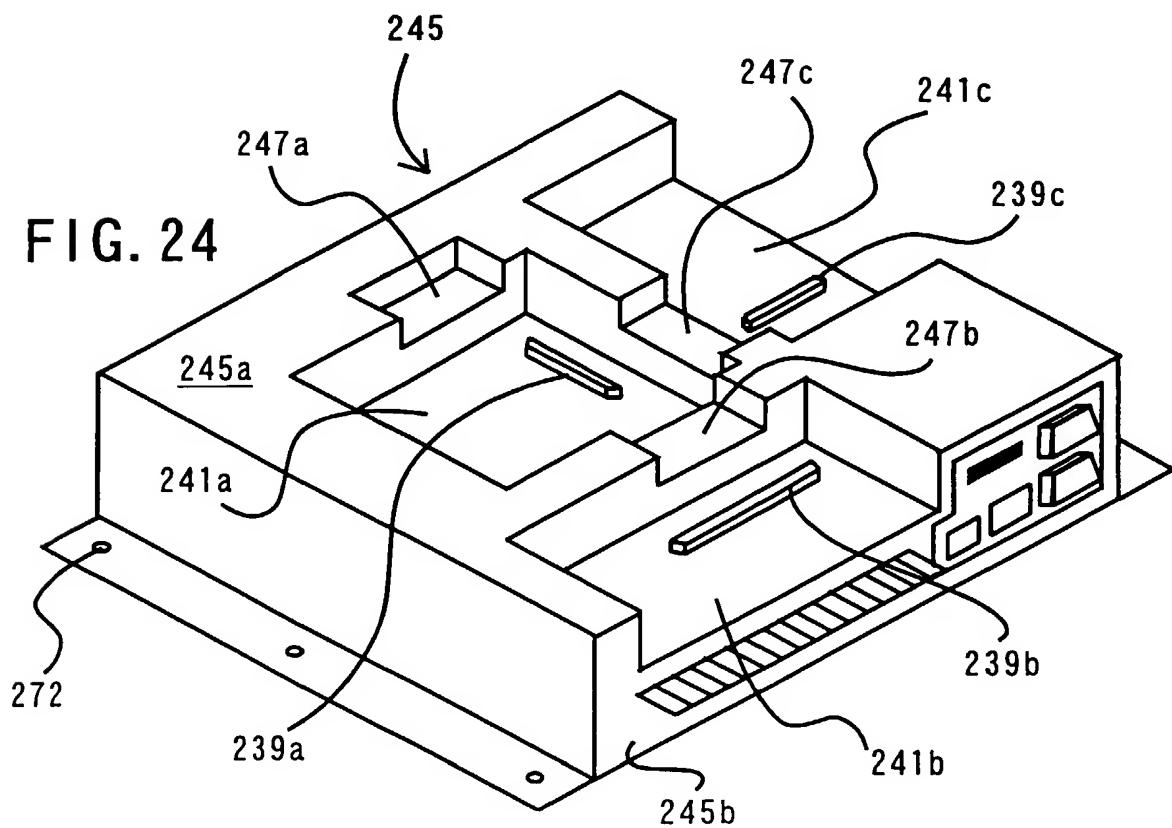


FIG. 24



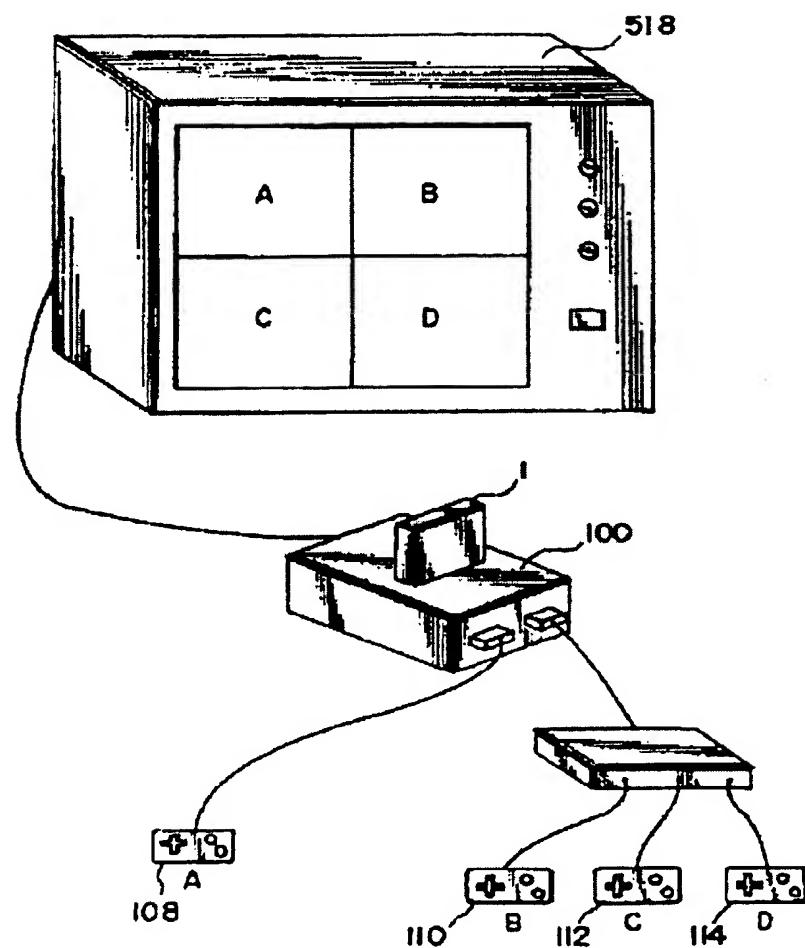


FIG. 25

GAME MACHINEBACKGROUND OF THE INVENTION1. Field of the Invention

The present invention relates to stand-alone game machines, and in particular to stand-alone game machines whose operation unit and the game software memory can be exchanged (replaced) easily.

2. Description of the Related Art

Changing the game software of a game machine makes it possible to enjoy a plurality of games using a single game machine cabinet. Changing the game software sometimes means that the control panel has to be replaced. Configurations in which the control panel can be removed from a game machine cabinet and can be replaced with another control panel are known in the art (for example, Japanese Patent Kokai (Laid-Open Publication) No. 06-296756).

The following description of the game machine of Japanese Patent Kokai No. 06-296756 uses the same component names as those used in Japanese Patent Kokai No. 06-296756.

With the game machine disclosed in Japanese Patent Kokai No. 06-296756, the control panel can be slid into the cabinet in a fixed direction. First connectors extend from the rear surface of the control panel in the sliding direction. Second connectors are attached to the cabinet such that the second connectors are engaged with the first connectors when the control panel has been slid in. The cabinet has a control panel support, which includes a bottom plate, left and right lateral

walls, and a rear wall. Slide guides extending in the front to back direction (sliding direction) are formed in the left and right lateral walls. The control panel is shaped so that it fits into the control support. The left and right lateral walls of the control panel are provided with guide protrusions that engage with and are guided by the slide guides of the left and right lateral walls of the control panel support, so that the control panel can slide in the front to back direction. Consequently, with respect to the control panel support, the control panel can only slide in the direction defined by the slide guides and the guide protrusions engaging one another.

With the game machine of Japanese Patent Kokai No. 06-296756, it is necessary to provide the control panel support in the game machine cabinet, to form the slide guides in the left and right lateral walls of the control panel support, and to provide the guide protrusions, which engage with the slide guides, in the left and right lateral walls of the control panel. In addition, sliding can only occur in the front to back direction defined by the slide guides and the guide protrusions engaging one another. That is, there is little degree of freedom in the task of removing and attaching the control panel.

Japanese Patent Kokai No. 06-296756 makes no disclosure regarding the manner in which game software is exchanged, and only mentions replacing the game software circuit board, on which game software is incorporated, with a separate circuit board. A conceivable method for replacing the game software circuit board with another circuit board is to open up the rear

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surface, for example, of the game machine cabinet and then remove the game software circuit board.

A home video game machine is shown in Fig. 25 of the accompanying drawings. For example, as disclosed in Japanese Patent Kokai No. 06-238064, the home video game machine includes a game console 100, a game cartridge 1 that is inserted upright into the game console 100, a first cord that extends from the game console 100, a controller 108 that is connected to the first cord, and a second cord for connecting the game console 100 to a television 518. It should be noted that the names and reference numerals of the components are the same as those used in Fig. 7 of Japanese Patent Kokai No. 06-238064.

A program, for example, that creates a three-dimensional image is stored on the game cartridge 1, and is capable of outputting image information. The game console 100 uses the image information to synthesize and output images that will be displayed on the television 518. A recess is formed in the top surface of the game console 100, and a connector half is exposed at the bottom of this recess. Another connector half is provided at the lower surface of the game cartridge 1, and this connector half can be connected to the connector half that is provided in the recess of the game console 100.

To play a game, a player first inserts the game cartridge 1 into the game console 100. Next, the player operates the controller 108 to display video images of a racing game or a combat game, for example, on the television 518. The game cartridge 1 can be inserted into and removed from the game

console 100.

If a player wishes to play a different game, the player exchanges (replaces) the game cartridge 1 with a separate cartridge. When removing the cartridge 1, the player grabs and pulls up the portion of the cartridge 1 that is exposed (protruding). Then, the player can insert into the game console 100 a game cartridge on which separate game software has been installed.

It should be noted that in Fig. 25 there are four controllers (controllers 108, 110, 112, and 114) so that four players A, B, C, and D can play games simultaneously. Also, four screens for the four players A, B, C, and D are displayed on the television 518.

With this conventional video game machine, most of the game cartridge 1 sticks out from the game console 100, that is, is exposed, when the game cartridge 1 is inserted into the game console 100. Consequently, there was a risk that the cartridge 1 would be damaged if the player or another person inadvertently struck the exposed portion of the cartridge 1 with a part of his body (hands or feet, for example). There was also the risk that this would damage not only the cartridge 1 but also the game console 100.

Also, the cartridge 1 is maintained in an upright inserted position only by the shallow recess of the game console 100, and thus in an upright inserted position the cartridge 1 is not stable. Consequently, there was the risk that sufficient contact between the connector half provided in the cartridge

1 and the connector half provided in the game console 100 would not be achieved (particularly if the game is played for long periods or if the cartridge 1 is exchanged frequently).

With the structure shown in Fig. 25, to exchange the cartridge 1 it is necessary to grab and pull up the exposed part of the cartridge 1, and thus a relatively large (high) exposed portion is necessary.

In the case of arcade game machines, the cartridge 1 and the game console 100 are placed inside the cabinet of the game machine, and therefore the player or other persons cannot bump into the exposed portion of the cartridge 1. However, the cartridge 1 in an upright inserted position is not stable, and there is a risk that the connection between connector halves is not sufficient. Also, with some arcade game machines the game console 100 is not placed horizontally. That is, the game console 100 is attached to a vertical wall, for example. In such cases, the cartridge 1 protrudes horizontally from the game console 100 (like a cantilever), and it is conceivable that the degree of stability of the connection between the cartridge 1 and the game console 100 will drop even further. For example, if the player kicks or shakes the arcade game machine, then there is the possibility that the cartridge 1 will dislodge from the game console 100 and fall.

Also, in the case of some arcade game machines, the cartridge 1 and the game console 100 are formed into a single unit (for example, provided as a game software circuit board). In order to play different games, the cartridge 1 and the game

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console were both exchanged at the same time as a single unit. Because game consoles are fixedly arranged inside the game machine cabinet, it is not easy to exchange the game consoles.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a game machine with which the operation unit is replaced easily.

It is another object of the present invention to provide a game machine with which game software titles are replaced easily.

It is a yet further object of the present invention to provide a control device of a game machine with which game software titles can be replaced easily.

According to a first aspect of the present invention, there is provided a game machine including a main body that is placed on a floor surface, an image display screen provided in an upper portion of the main body, an operation unit that is provided in a mid-height portion of the main body and that receives operation input, and a control device that is provided inside the main body and that carries out game software processes, including operations for displaying images on the image display screen, in response to the operation input. The control device and the operation unit are electrically connected to each other in a detachable manner, and the control device includes a replaceable game software memory. With this game machine, the operation unit can be exchanged easily. The game software can also be exchanged easily.

It is preferable that an opening is formed below the image

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display screen in the main body of the game machine, and that the opening is closed by a removable door member. Also, it is preferable that the control device is located behind the door member.

According to a second aspect of the present invention, there is provided an improved control device, situated inside a main body of a game machine, for carrying out game software processing, including operations for displaying images on an image display screen in response to operation input. The game machine includes the main body, which is placed on a floor surface, an image display screen provided in an upper portion of the main body, and an operation unit that is provided in a mid-height portion of the main body to receive the operation input. The control device includes a display controller for controlling the display of the image display screen, a memory for holding basic operations control software and game processing software, and a central control unit for controlling the display controller while executing the basic operations control software and the game processing software in response to the operation input from the operation unit. A bus line electrically connects the display controller, the memory, and the central control unit to one another. A casing of the control device has a connector for connecting the bus line to the operation unit and the display screen. Electrical circuits operating as the display controller, the memory, and the central control unit are provided in the form of a plurality of circuit modules. The control device casing has a recess in its top

surface, and in the bottom of the recess there is a first connector half that is connected to the bus line. At least one of the circuit modules is fitted into the recess and in its bottom portion has a second connector half that is attachable/detachable to the first connector half. At least one finger insert recess is formed in at least one lateral wall of the recess. With this control device, game software can be replaced easily and reliably.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 illustrates a perspective view of an arcade game machine according to the first embodiment of the present invention.

Fig. 2 illustrates a block diagram of the arcade game machine shown in Fig. 1.

Fig. 3 illustrates a perspective view of the control device of the arcade game machine shown in Fig. 1.

Fig. 4 illustrates a perspective view of the control device when the cartridges are removed from the control device.

Fig. 5 is a perspective view of the game machine shown in Fig. 1 when the operation unit is removed from the game machine.

Fig. 6 is a partial cross-sectional side view of the game machine of Fig. 1 after the operation unit is removed.

Fig. 7 shows a perspective view of the operation unit that is removed from the game machine of Fig. 1.

Fig. 8 shows a plan view of another operation unit that can be attached to the game machine of Fig. 1.

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Fig. 9 shows a plan view of still another operation unit that can be attached to the game machine of Fig. 1.

Fig. 10 shows a plan view of yet another operation unit that can be attached to the game machine of Fig. 1.

Fig. 11 shows a plan view of another operation unit that can be attached to the game machine of Fig. 1.

Fig. 12 shows a perspective view of the game machine when the operation unit of Fig. 11 is attached.

Fig. 13 is a partial cross-sectional side view of the game machine shown in Fig. 12 when a player seated on a seat structure is playing the game.

Fig. 14 is a magnified cross-sectional view of near the pedal unit of the game machine of Fig. 12.

Fig. 15 is a partial cross-sectional side view of the game machine of Fig. 12 when the seat is removed from the game machine.

Fig. 16 is a perspective view schematically showing the operation unit of the game machine shown in Fig. 1 when the top panel of the operation unit is open.

Fig. 17 illustrates a perspective view of an arcade game machine according to the second embodiment of the present invention.

Fig. 18 is a partial cross-sectional side view of the game machine of Fig. 17 when the player is seated.

Fig. 19 illustrates a block diagram of the game machine of Fig. 17.

Fig. 20 illustrates a perspective view of the control device of the game machine shown in Fig. 17.

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Fig. 21 is a perspective view of the control device of Fig. 20 when the cartridges are removed from the control device.

Fig. 22 is an enlarged perspective view of the rear surface of the control device shown in Fig. 20.

Fig. 23 illustrates a perspective view of a modification of the control device shown in Fig. 20.

Fig. 24 illustrates a perspective view of the control device shown in Fig. 23 when the cartridges are removed from the control device.

Fig. 25 is a diagram that schematically shows a conventional game machine.

DETAILED DESCRIPTION OF THE INVENTION

First Embodiment

A first embodiment of the present invention is described in detail with reference to Figs. 1 to 16 of the appended drawings.

Referring to Fig. 1, the outer appearance of a stand-alone arcade game machine 10 of this embodiment is illustrated. The arcade game machine 10 has a cabinet 14 that can be set on a floor surface 12 of an arcade game center, for example. An image display screen (display unit) 16 is provided in the upper portion of the cabinet 14, and an operation unit 18 is provided substantially in the center of the cabinet 14 in the height direction. The image display screen 16 is positioned at the eye-level (or slightly below eye-level) of a player that is standing. Also, the operation unit 18 is located at a height at which the player can easily operate the operation unit 18

while viewing the image display screen 16. A removable plate (door member) 20 is provided between the image display screen 16 and the operation unit 18. The plate 20 is fastened to the cabinet 14 by screws 21, for example. A control device 44 (described later) is provided inside the game machine cabinet 14 behind the plate 20. Game sound is generated from a speaker set 26 provided on either side of the image display screen 16. The image display screen 16 is a VGA (video graphics array) monitor, for example. The speaker set 26 is a stereo speaker set for which the volume can be controlled.

The game machine 10 is a game machine that uses joysticks. The operation unit 18 is provided with two joysticks 22. Three push buttons 24 are provided accompanying (adjacent to) each joystick 22. Thus, two sets each with a joystick 22 and push buttons 24 are arranged next to each other, thereby making it possible to operate the game machine 10 with one or two players. The reference numeral 28 denotes a money (game fee) or coin insert slot, and the reference numeral 30 denotes a return tray.

Referring to Fig. 2, a block diagram showing the configuration of the game machine 10 is depicted. As shown in the drawing, the game machine 10 includes a central control portion 50, a display device 52, a display controller 53, an interface 54, a communications control device 56, a control software memory (storage) 58, a memory interface 60, an operation input controller 62, a game software storage memory 64, and an operation input unit 66. These structural components are connected by a bus line 55.

The display device 52 includes the image display screen 16 and the speaker set 26 of Fig. 1. The central control portion 50 includes a central processing unit (CPU) for controlling the operations of the various portions of the game machine 10. The display controller 53 is connected to the display device 52 and the central control portion 50, and two-dimensionally or three-dimensionally processes the image data. That is, the display controller 53 controls the display on the image display screen 16 of Fig. 1.

The interface 54 is connected to the display controller 53, and includes a VDAC (video digital to analog converter) and an ADAC (audio digital to analog converter). The VDAC converts the image data, which are software processed, into analog video (VGA) signals and outputs these signals to the image display screen 16 (display device 52). The ADAC converts the digital audio data, which are software processed, into analog audio signals and outputs these signals to the speaker set 26 (display device 52).

The communications control device 56, which is connected to the central control unit 50, and has a function for realizing data transmission between the game machine 10 and an outside device. Preferably the communications control device 56 has a LAN communications function such as Ethernet (registered trademark), a modem for realizing the data transmission over a public telephone line, and an NCU (network control unit) that allows dial-up connection.

The control software memory 58 is connected to the central

control unit 50 and stores a program that governs all the basic controls of the game machine 10 and also the common controls that are not dependent on the game software. This allows the initial operations and the basic operations of the game machine 10, which are not dependent on the game, to be performed.

The operation input controller 62 functions as an interface for the operation input signals, which are different depending on the type of operation input unit, and is capable of accommodating parallel or serial digital signals or analog input/output signals corresponding to the type of operation input unit 66. The operation input controller 62 also serves as an interface for a coin counting device 61. The coin counting device 61 counts the number of monetary or monetary-like coins that the player inserts into the coin insert slot 28 as his play fee.

The operation input unit 66 is the operation unit 18 of Fig. 1. It should be noted that in the case of a driving-game type game machine (Fig. 12), the operation input unit 66 includes the operation unit 18 and a pedal unit 15. The pedal unit 15 is provided in the lower portion of the game machine 10, and thus can also be called a foot-operated unit. The operation unit 18 can be thought of as a first operation unit, the pedal unit 15 can be thought of as a second operation unit, and together the two can be collectively thought of as the operation unit.

The memory interface 60 is connected to the central control unit 50, and performs readout of gateway software

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between the game software storage memory 64 and the central control unit 50.

The game software storage memory 64 is detachably connected to the memory interface 60, and normally stores one type of game software. In this embodiment, the game software storage memory 64 is a ROM cartridge that is detachably connected to the memory interface 60. The ROM cartridge preferably has a storage capacity of 128 Mbytes and a security function for preventing pirating of the software by copying.

All of the structural components of the game system 10 shown in Fig. 2 are included in the control device 44 except for the display device 52 and the operation input unit 66. Consequently, without the interfaces, the control device 44 can be regarded as made of the display controller 53 for performing the display controls of the image display screen 16, the memory 58 holding the basic operations control software and the game processing software, and the central control unit 50 that controls the display while running the basic operations control software and the game processing software in correspondence with operations input through the operation unit. The display controller 53, the memory 58, and the central control unit 50 are electrically connected to one another by the bus line 55.

When depicted in a block diagram, the control device 44 has a configuration like that of Fig. 2, however, if the electrical circuits are taken into account, then the display controller 53, the memory 58, and the central control unit 50 are configured as a plurality of circuit modules. One of these

modules is the game software storage memory (ROM cartridge) 64.

As shown in Fig. 3, when taken as a whole, the control device 44 presents a substantially rectangular parallelepiped shape. In Fig. 3, if the outer appearance of the control device 44 is observed, the control device 44 includes a rectangular parallelepiped casing structure 45, a ROM cartridge 64a, an extended I/O cartridge 64b, a communications cartridge 64c, an edge port 65 of the motherboard, and other ports/terminals. These other ports/terminals are for example a modem connection port 71, a VGA output port 67, and a stereo speaker output and extended serial port 68. A DIP switch 69 for switching between 15 kHz and 32 kHz is provided next to the port 68, and a speaker volume 70 is provided above the port 68. The volume from the speaker set 26 is changed when the speaker volume 70 is turned. The motherboard is a circuit module that is provided inside the casing 45. In Fig. 3, the edge port 65 of the motherboard is protruding from the casing 45. Inside the casing 45 the motherboard is provided with the central control unit 50 and the control software memory 58. The edge port 65 of the motherboard, the other ports 66, 67, and 68, the DIP switch 69, and the speaker volume 70 are arranged concentrated on one lateral surface 45b of the casing 45. In this embodiment, this lateral surface is referred to as the primary surface of the casing structure 45.

Fig. 4 shows the casing structure 45 when the ROM cartridge 64a, the extended I/O cartridge 64b, and the communications cartridge 64c have been removed from the casing structure 45.

As shown in the drawing, a top surface 45a of the casing structure 45 has a first recessed portion 41a, a second recessed portion 42b, and a third recessed portion 41c. The ROM cartridge 64a is inserted into the first recessed portion 41a, the extended I/O cartridge 64b is inserted into the second recessed portion 41b, and the communications cartridge 64c is inserted into the third recessed portion 41c. A connector half 39a is provided on the bottom surface of the first recessed portion 41a. This connector half 39a extends from the motherboard. The ROM cartridge 64a is provided with a connector half (not shown) in its bottom surface, and in the state of Fig. 3 (in which the ROM cartridge 64a is fitted in the casing structure 45), this connector half is connected to the connector half 39a of the casing structure 45. Similarly, a connector half 39b extending from the motherboard is located in the bottom surface of the second cartridge recess 41b and the extended I/O cartridge 64b is provided with a connector half (not shown) in its bottom surface, and in the state of Fig. 3, this connector half is connected to the connector half 39b. Also, a connector half 39c extending from the motherboard is located in the bottom surface of the third cartridge recess 41c and the communications cartridge 64c is provided with a connector half (not shown) in its bottom surface, and in the state of Fig. 3, this connector half is engaged with the connector half 39c.

As is best seen in Fig. 3, when the three cartridges 64a, 64b, and 64c are fitted in the casing structure 45, the top surface 45a of the casing structure 45 and the top surfaces 64d

of each of the cartridges 64a, 64b, and 64c are flush with each other. Thus, the ROM cartridge 64a, the extended I/O cartridge 64b, and the communications cartridge 64c can be regarded as fit-in circuit modules that are received into the cartridge recesses 41a, 41b, and 41c, respectively, of the casing structure 45.

A first finger recess 47a, a second finger recess 47b, and a third finger recess 47c, each of a size that allows a person's finger to be inserted therein, are formed in lateral wall surfaces of the cartridge recess 41 of the casing structure 45. The first and second finger recesses 47a and 47b are provided so that an operator or service man can easily grab the ROM cartridge 64a when removing the ROM cartridge 64a from the casing structure 45. That is, the service man inserts his fingers into the first and the second finger recesses 47a and 47b, grips the ROM cartridge 64a, and then removes (lifts up) the ROM cartridge 64a from the casing structure 45. When the service man wishes to remove the extended cartridge 64b from the casing structure 45, he for example inserts his thumb into the second finger recess 47b and with his remaining fingers grabs the opposite side of the extended cartridge 64b and removes it. Similarly, if the service man wishes to remove the communications cartridge 64c from the casing structure 45, the service man for example inserts his thumb into the third finger recess 47c and with his remaining fingers grabs the opposite side of the communications cartridge 64c and removes it. It should be noted that using only the first and the second finger

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recesses 47a and 47b when removing the ROM cartridge 64a is an ideal (typical) case, however, if necessary it is also possible to use the third finger recess 47c as well.

As is clear from Figs. 3 and 4, one of the lateral walls (on the primary surface 45b side of the casing structure 45) of the second cartridge concave 41b is open, and one of the lateral walls of the third cartridge concave 41c is also open. Also, the second finger recess 47b formed in a lateral wall of the first cartridge concave 41a is also the finger recess formed in a lateral wall of the second cartridge concave 41b. Similarly, the third finger recess 47c that is formed in a separate lateral wall of the first cartridge concave 41a is also the finger recess that is formed in a lateral wall of the third cartridge concave 41c.

That is, in this embodiment, the two adjacent cartridge concaves 41a and 41b (or 41a and 41c) are in communication with one another by a single finger recess 47b (or 47c). It should be noted that the number of finger recesses 47 is not limited to three. For example, the number of finger recesses can be four or more taking into consideration work efficiency and/or manufacturing costs, for example. Also, the locations and shapes of the finger recesses 47 are not limited to those illustrated in Figs. 3 and 4. For example, an optimal location and shape can be suitably chosen to ease removal of the cartridges. Also, the locations of the cartridge concaves are not limited to those shown in the drawings. For example, the first cartridge concave 41a may be in contact with a rear surface

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45c of the casing 45. That is, one of the lateral walls of the first cartridge concave 41a can be open on the rear surface 45c side of the casing 45. It should be noted that there may also be cases in which the extended cartridge 64b and the communications cartridge 64c are not provided. That is, the control device may only have the ROM cartridge 64a. The reference numeral 72 denotes apertures through which screws for fastening the casing structure 45 (or the control device 44) to a mount 46 are passed. The mount 46 is fixed to the game machine cabinet 14.

The communications cartridge 64c is utilized for communicating with other game machines. For example, providing the communications cartridge 64c allows the game machine 10 to be connected to separate game machines via wiring. The extended I/O cartridge 64b is a cartridge for using an I/O (input/output) not in the basic specifications. For example, providing the extended I/O cartridge 64c allows one or two light-input type gun controllers to be connected. It should be noted that what is left after the cartridges 64a, 64b, and 64c are removed from the control device 44 may be referred to as the motherboard.

An operation signal that is input from the operation unit 18 is introduced to the control device 44 via cables 77 and 48 (Fig. 5). The control device 44 operates the image display screen 16 in accordance with the design of the motherboard, the content of the game software of the ROM cartridge 64a, and the operations (instructions, commands, data, values, signals,

movements, etc.) that are input from the input unit 66. That is, the control device 44 performs game processing, including operations for displaying images on the image display screen 16, in response to the operations that are input. The ROM cartridge 64a is a replaceable game software storage.

As shown in Fig. 5, the operation unit 18 can be removed from the game machine cabinet 14. The operation unit 18 is placed on an operation unit mount 14a that extends horizontally outward from the center portion of the game machine cabinet 14, and is fastened to the operation unit mount 14a by a plurality of bolts 13 (Fig. 13). The reference numeral 13a denotes bolt holes into which the bolts 13 are screwed. To remove the operation unit 18 from the game machine cabinet 14, first a lock 11 that is provided in a top panel 18a of the operation unit 18 is unlocked. The lock 11 is located near the right-side push buttons 24. When the lock 11 is unlocked, the top panel 18a of the operation unit 18 can be opened (pivoted, lifted) forward to a generally upright position as shown in Fig. 16. As shown in Fig. 16, the top panel 18a of the operation unit 18 is opened forward and stops at a predetermined position (for example, tilted approximately 110° or 120°). A hinge 87 provided between the upper panel 18a and the operation unit 18 holds the upper panel 18a in the predetermined position mentioned above. A connector 17 and a power switch 89a are provided below a panel 20 of the primary surface of the game machine cabinet 14. The connector 17 and the power switch 89a are exposed (the service man has access to them) when the upper panel 18a of the operation

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unit 18 is opened. A service man turns off the power switch 89a of the game machine 10 and then removes wiring 77 from the connector 17. The wiring 77 links the operation unit 18 (more specifically, the joystick 22 and the push buttons 24) and the connector 17. Next, the service man unscrews the bolts 13. By doing this, the control unit 18 is freed (completely removed) from the game machine cabinet 14 (more precisely, the mount 14a). The connector 17 is fixed to the outside surface of the game machine cabinet 14. The power switch 89a is also attached to the outside surface of the game machine cabinet 14. When the operation unit 18 is mounted to the game machine cabinet 14, the connector 17 and the power switch 89a are located inside the operation unit 18 (they are hidden by the operation unit 18). It should be noted that a power switch 89b (Fig. 6) is also provided in the lower portion of the rear surface of the game machine 10, and it is possible to turn off the power switch 89b instead of turning off the power switch 89a. It is also possible to provide the power switch 89a on the mount 14a.

Fig. 6 is a partial cross-sectional side view showing the game machine 10 after the operation unit 18 is removed from the game machine cabinet 14. From the connector 17, a separate cable 48 extends to the control device 44 of the game machine. The control device 44 is fastened to the mount 46. Fig. 7 shows the operation unit 18 that is removed.

If the operation unit 18 is to be replaced with a separate operation unit, then that separate operation unit can be attached to the game machine cabinet 14 by performing the

above-mentioned removal procedure in reverse. Examples of other operation units are shown in Figs. 8 through 11. The operation unit 18 of Fig. 8 is provided with two groups of five push buttons 24, each group accompanying one joystick 22. The operation unit 18 of Fig. 9 has two trackballs 79, each trackball accompanied by three push buttons 24. The operation unit of Fig. 10 is a gun-type operation unit. The reference numerals 80 denote guns. The operation unit of Fig. 11 is a drive-type operation unit, and is provided with a steering wheel 34 and a shift lever 32. The shift lever 32 may have a high speed position and a low speed position.

If the game software is exchanged at the same time that the operation unit 18 is exchanged, the service man removes the operation unit 18 and the plate 20 below the image display screen 16 from the game machine cabinet 14. It should be noted that the service man may only remove the plate 20 at this point, and may remove the operation unit 18 later. To remove the plate 20, the screws 21 can be loosened and removed. By removing the plate 20, a large opening is created below the image display screen 16. The control device 44 is provided near this opening inside the game machine cabinet 14. The service man reaches into the opening and for example grabs and removes the ROM cartridge 64a from the casing structure 45 of the control device 44. Accordingly, in a case where the operation unit 18 and the ROM cartridge 64a are removed at the same time, the service man can perform these tasks (without hardly changing his location) standing at the primary surface of the game machine cabinet 14.

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Fig. 12 shows the game machine 10 when the operation unit 18 of Fig. 11 is attached. This game machine 10 is a driving game machine. The pedal unit 15 is provided in the lower portion of the game machine cabinet 14. Also, the game machine cabinet 14 is provided with a seat (bench) 19 on which the player can sit as he enjoys the game. The pedal unit 15 and the seat 19 can be retrofitted to the game machine cabinet 14. The drive-type operation unit 18 is larger than the operation unit of Fig. 1, and thus an additional support member 23 for supporting the operation unit 18 is attached to the game machine cabinet 14 (Fig. 13). The support member 23, which has a surface that expands and extends forward from the operation unit mount 14a, is fastened to the game machine cabinet 14 by the bolts 13. In other words, the support member 23 and the mount 14a define in combination an enlarged mount (surface) for the larger operation unit 18. After the support member 23 is attached to the game machine cabinet 14, the operation unit 18 is set on the mount 14a and the support member 23. The support member 23 is an additional mount member having an L-shaped cross section. The ROM cartridge 64a is exchanged with software for a driving game. Other than this, the structure of the game machine 10 is identical to that shown in Fig. 1. Thus, it is possible to achieve a completely different game machine (from a joystick-type game machine to a drive-type game machine) without having to exchange the game machine cabinet 14, the image display screen 16, and the casing structure 45 of the control device.

The shift lever 32, the steering wheel 34, and a game start button 36 are arranged on the operation unit 18. The shift lever 32 is for example capable of shifting into a high gear (H) position, a neutral (N) position, and a low gear (L) position. The pedal unit 15 includes an accelerator pedal 15a and a brake pedal 15b. During the game, a road, a background, a speedometer, a tachometer, the traveling distance, the time remaining in the game, and the points (game points), for example, are displayed on the image display screen 16.

Fig. 13 is a partial cross-sectional side view of the game machine 10 shown in Fig. 12, and shows a state in which a player 42 is seated on the seat 19 and playing the game. The player 42 plays the driving game by manipulating the steering wheel 34 and the shift lever 32 as he steps down on or releases the accelerator pedal 15a or the brake pedal 15b. The seat 19 has the shape of an L when viewed from the side. The seat 19 is primarily made of two (right and left) horizontal members 19b that are in contact with the floor surface 12 and are fastened to the lower portion of the game machine cabinet, upright members 19c that extend vertically from the horizontal members 19b, a connection member 19d that is in contact with the floor surface 12 and links the two horizontal members 19b to each other, and another connection member 19a spanning the upper ends of the upright members 19c for supporting a person's buttocks. The buttocks support member 19a has a cushion made of a material that is relatively soft. The pedal unit 15 is linked to the control device 44 by a cable 48a, for example. It should be

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noted that the horizontal members 19b and the lower connection member 19d are exposed in Fig. 12, however, it is also possible to provide a member to cover the horizontal members 19b and/or lower connection member 19d. It is possible for this cover member to close or block the recessed portion (hollow space) between the pedal unit 15 and the lower connection member 19d. Alternatively, it is possible for the size of the pedal unit 15 to be increased so that it blocks the recessed portion (hollow space) between the pedal unit 15 and the lower connection member 19d.

Parts for attaching the pedal unit 15, the seat 19, and the game machine cabinet 14 with each other are shown in detail in Fig. 14. The lower end of the cable 48a, which extends from the control device 44 to the lower portion of the game machine cabinet 14, passes through a hole 82 formed in the lower portion of the game machine cabinet 14 to the outside of the game machine cabinet 14. The lower end of the cable 48a is then connected to a cable 83, which extends from the accelerator pedal 15a and the brake pedal 15b. The cable 48a is connected to the cable 83 inside a housing 15c of the pedal unit. The extent to which the accelerator pedal 15a and the brake pedal 15b are stepped on (the amount they are pushed down) is converted into an electrical signal by a converter 81 arranged inside the housing 15c of the pedal unit 15 and then supplied to the control device 44 by way of the cable 83 and the cable 48a. The lower portion of the game machine cabinet 14 and the free ends (or their vicinity) of the horizontal members 19b of the seat 19 are joined

by bolts 86 via hinges 85. The pedal unit 15 is either linked to the game machine cabinet 14 by the bolts 86 or is linked to the horizontal members 19b of the seat 19. It should be noted that it is also possible to further extend the horizontal members 19b forward and position the entire bottom portion of the game machine cabinet 14 on the horizontal members 19b.

The control device 44 receives operations input from the operation unit 18 and the pedal unit 15, and carries out the game processing on the image display screen in correspondence with the operations that are input. The game processing includes operations for displaying images.

It should be noted that if the game machine 10 is not provided with the seat 19, then, as shown in Fig. 15, the pedal unit 15 is set on the floor surface 12 and an attachment 88 is provided in between the game machine cabinet 14 and the pedal unit 15. Inside the attachment 88 the cable 48a and the cable 83 are connected to one another. The attachment 88 is fastened to the game machine cabinet 14 by bolts or the like, and the pedal unit 15 is fastened to the attachment 88 by bolts or the like.

The service man may desire to exchange only one or some components of the operation unit 18 without exchanging the entire operation unit 18. For example, the service man desires to exchange only the joysticks 22 of Fig 1 with the trackballs 79. Such an exchange is preferred because it allows costs to be kept lower than if the entire operation unit 18 is replaced. When exchanging parts only, such as above, the service man first

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unlocks the lock 11 provided on the operation unit 18. Then, the top panel 18a of the operation unit 18 is opened forward as shown in Fig. 16 and stops after it is tilted approximately 110° or 120°. The service man then turns off the power switch 89a, removes the joysticks 22 and wiring, and then attaches the trackballs 79 and wiring. Then, the service man closes the top panel 18a and locks it using the lock 11. Examples of part exchanges include exchanges between joysticks and trackballs, between joysticks and guns, and between guns and trackballs.

As described above already, the power switch 89b of the game machine is provided in the lower portion of the game machine cabinet 14 on its rear surface. Consequently, by manipulating the switch 89b on the rear surface of the cabinet 14, the power of the game machine can be turned off without opening the top panel 18a of the operation unit 18. If the location of the game machine 10 does not allow a service man to reach behind to the lower portion of the rear surface of the game machine cabinet 14 (e.g., when the game machine 10 is close to a wall), the game machine can be turned off simply by unlocking the lock 11 and manipulating the switch 89a. The game machine itself is quite heavy.

It should be noted that in Fig. 13, the support member 13 was attached to the game machine cabinet 14, however, it is of course not necessary to provide the support member 13 if the operation unit 18 can be adequately supported by only the operation unit mount 14a.

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Second Embodiment

A second embodiment of the present invention is described in detail with reference to Figs. 17 to 24.

Fig. 17 shows the outer appearance of an arcade game machine 210 of the embodiment. The arcade game machine 210 has a cabinet 214 that can be set on a floor surface 212 of an arcade game center, for example. An image display screen (display) 216 is provided in the upper portion of the cabinet 214, and an operation unit 218 is provided substantially in the center of the cabinet 214 in the height direction. A pedal unit 215 is provided in the lower portion of the cabinet 214. The game machine cabinet 214 is also provided with a seat (bench) 219, on which a player can sit as he enjoys the game.

The seat 219 has the shape of an L when viewed from the side (see Fig. 18). The seat 219 is primarily made of two horizontal members 219b that are in contact with the floor surface 212 and fastened to the lower portion of the game machine cabinet, upright members 219c that extend vertically from the horizontal members 219b, a lower connection member 219d that is in contact with the floor surface 212 and links the horizontal members 219b to each other, and an upper connection member 219a that connects upper ends of the upright members 219c for supporting a person's buttocks. The buttocks support member 219a has a relatively soft cushion.

The image display screen 216 is positioned at the eye-level (or slightly below eye-level) of a player that is standing. Also, the operation unit 218 is located at a height

at which the player can easily operate the operation unit 218 while viewing the image display screen 216 from a seated position on the seat 219. A removable plate (door member) 220 is provided between the image display screen 216 and the operation unit 218. The plate 220 is fastened to the cabinet 214 by screws 221, for example. Game sound is generated from a speaker set 226 provided on either side of the image display screen 216. The image display screen 216 is a VGA (video graphics array) monitor, for example. The speaker set 226 is for example a stereo speaker set for which the volume can be controlled.

The game machine 210 is a game machine for a driving-type game. On the operation unit 218 are arranged a shift lever 232, a steering wheel 234, and a game start button 236. The shift lever 232 is for example capable of shifting into a high (H) position, a neutral (N) position, and a low (L) position. The pedal unit 215 has an accelerator pedal 215a and a brake pedal 215b. During the game, a road, a background, a speedometer, a tachometer, the traveling distance, the time remaining in the game, and the points (game points), for example, are displayed on the image display screen 216. The reference numeral 228 denotes a money (or coin) insert slot, and 230 denotes a return tray.

Fig. 18 is a partial cross-sectional side view of the game machine 210 shown in Fig. 17 when a player 242 is playing the game seated on the seat 219. The player 242 plays the driving game by manipulating the steering wheel 234 and the shift lever

232 as he steps down or releases the accelerator pedal 215a or the brake pedal 215b.

A control device 244 is provided near the removable plate 220 inside the game machine cabinet 214, and is set on a mount 246. The mount 246 is fastened to the game machine cabinet 214. The control unit 218 is connected to the control device 244 via a cable 277, a connector 217, and a cable 248, and the pedal unit 215 is connected to the control device 244 by a cable 248a. The control device 244 receives the operations input from the operation unit 218 and the pedal unit 215, and performs the game processing on the image display screen in correspondence with the operations that are input. The game processing includes operations for displaying images.

The mount on which the operation unit 218 is set extends toward the player 242 from near the middle of the game machine cabinet 214. The operation unit 218 that is shown is comparatively large, and thus an additional support member 223 is attached to the mount of the game machine cabinet 214. The support member 223 is an auxiliary member with an L-shaped cross section. The mount and the support member 223 together form a large flat surface (mount), and the operation unit 218 is fixedly located onto this flat surface by bolts 213.

Fig. 19 is a block diagram showing the structure of the game machine 210. As shown in the drawing, the game machine 210 includes a central control portion 250, a display device 252, a display controller 253, an interface 254, a control software memory (storage) 258, a memory interface 260, an

operation input controller 262, a game software storage memory 264, and an operation input unit 266. These structural components are connected by a bus line 255. The display device 252 includes the image display screen 216 and the speaker set 226 of Fig. 17.

The central control portion 250 includes a central processing unit (CPU) for controlling the operations of the various portions of the game machine 210. The display controller 253 is connected to the display device 252 and the central control portion 250, and two-dimensionally or three-dimensionally processes the image data. That is, the display controller 253 controls the display of the image display screen 216 of Fig. 17.

The interface 254 is connected to the display controller 253, and includes a VDAC (video digital to analog converter) and an ADAC (audio digital to analog converter). The VDAC converts the image data, which are software processed, into analog video (VGA) signals and outputs these signals to the image display screen 216 (display device 252). The ADAC converter converts the digital audio data, which are software processed, into analog audio signals and outputs these signals to the speaker set 226 (display device 252).

The control software memory 258 is connected to the central control portion 250 and stores a program that governs all the basic controls of the game machine 210 and also the common controls that are not dependent on the game software. This allows the initial operations and the basic operations of the

game machine 210, which are not dependant on the game, to be performed.

The operation input controller 262 functions as an interface for the operation input signals, which differ depending on the type of operation input unit 266, and is capable of receiving parallel or serial digital signals or analog input/output signals corresponding to the type of operation input unit 266. The operation input controller 262 also serves as an interface for a coin counting device 261. The coin counting device 261 counts the number of monetary or monetary-like coins that the player inserts into the coin insert slot 228 as his play fee.

In the case of a driving-type game, the operation input unit 266 includes the operation unit 218 and the pedal unit 215. It should be noted that the operation unit 218 can be thought of as a first operation unit, the pedal unit 215 can be thought of as a second operation unit, and together the two can be collectively thought of as the operation unit. In the case of a game that uses joysticks, which does not have a pedal unit, the operation input unit 266 is made of only the operation unit 218. A joystick-type operation unit for example includes joysticks and push buttons or the like that are provided adjacent to the joysticks.

The memory interface 260 is connected to the central control portion 250, and performs readout of gateway software between the central control portion 250 and the game software storage memory 264.

The game software storage memory 264 is detachably connected to the memory interface 260, and normally stores one type of game software. In this embodiment, the game software storage memory 264 is a ROM cartridge that is detachably connected to the memory interface 260 via a connector half 239. The ROM cartridge preferably has a storage capacity of 128 Mbytes and a security function for preventing pirating of the software by copying.

All of the structural components of the game system 210 shown in Fig. 19 are included in the control device 244 except for the display device 252 and the operation input unit 266. Consequently, without the interfaces, the control device 244 can be regarded as being made of the display controller 253 for controlling the display of the image display screen 216, the memory 258 holding the basic operations control software and the game processing software, and the central control unit 250 that controls the display while running the basic operations control software and the game processing software in correspondence with operations input through the operation unit. The display controller 253, the memory 258, and the central control unit 250 are electrically connected to one another by the bus line 255.

When illustrated in a block diagram, the control device 244 has a configuration like that of Fig. 19, however, if the actual electrical circuits are taken into account, then the display controller 253, the memory 258, and the central control unit 250 are configured as a plurality of circuit modules. One

of these modules is the game software storage memory (ROM cartridge) 264.

Fig. 20 is a perspective view of the control device 244. When viewed as a whole, the control device 244 exhibits a substantially rectangular parallelepiped shape. In Fig. 20, from the outside the control device 244 can be seen to include a rectangular parallelepiped casing structure 245, the ROM cartridge 264, an edge port 265 of the motherboard, and other ports, for example. These other ports are for example a modem connection port 271, a VGA output port 267, and a stereo speaker output and extended serial port 268. A DIP switch 269 for switching between 15 kHz and 32 kHz is provided next to the port 268, and a speaker volume 270 is provided above the port 268. The volume from the speaker set 226 is increased when the speaker volume 270 is turned to the right, for example. The motherboard is a circuit module that is provided inside the casing structure 245, and the edge port 265 of the motherboard protrudes from the casing structure 245. Inside the casing structure 245 the motherboard is provided with the central control unit 250 and the control software memory 258. The edge port 265 of the motherboard, the other ports 266, 267, and 268, the DIP switch 269, and the speaker volume 270 are arranged concentrated on one lateral surface 245b of the casing structure 245. In this embodiment, this lateral surface 245b is referred to as the primary surface of the casing structure 245. Consequently, the port group (connectors) of the control device is provided only on the primary surface 245b of the casing structure 245. The

reference numeral 272 denotes apertures through which screws for fastening the casing structure 245 (or the control device 244) to the game machine cabinet are passed.

Fig. 21 shows the control device 244 when the ROM cartridge 264 is removed from the casing structure 245. As shown in the drawing, a top surface 245a of the casing structure 245 has a recessed portion 241. A connector half 239 is provided on the bottom surface of the recessed portion 241. The connector half 239 extends from the motherboard. The ROM cartridge 264 has a connector half (not shown) in its bottom surface, and in the state of Fig. 20 (in which the ROM cartridge 264 has been inserted), this connector half is engaged with the connector half 239 of the casing structure 245. As shown in Fig. 20, when the ROM cartridge 264 is fitted into the casing structure 245, the top surface 245a of the casing structure 245 is flush with the top surface 264d of the ROM cartridge 264. Thus, the ROM cartridge 264 can be regarded as a fit-in module that is received into the recessed portion 241 of the casing structure 245. The ROM cartridge 264 does not protrude from the casing structure 245.

Small recesses 247a and 247b, each of a size that allows a person's finger to be inserted therein, are formed in lateral wall surfaces of the cartridge recess 241 of the casing structure 245. The finger recesses 247a and 247b are provided so that an operator or service man can easily grab the ROM cartridge 264 when removing the ROM cartridge 264 from the casing structure 245. Specifically, the service man inserts

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his fingers into the finger recesses 247a and 247b, grips the ROM cartridge 264, and then removes (lifts up and pulls out) the ROM cartridge 264 from the casing 245. In this embodiment, each finger recess is of a size that allows about one or two fingers to be inserted therein. The size, shape, location, and number of the finger recesses are not limited to those shown in Figs. 20 and 21, as long as they allow the ROM cartridge 264 to be removed easily. For example, it is possible to provide four finger recesses around the ROM cartridge 264. It is necessary to remove the ROM cartridge 264 when different game software (another ROM cartridge) is to be inserted into the control device 244, for example. Also, if the ROM cartridge 264 is broken, then it must be removed and replaced by a new ROM cartridge 264 (of the same game). Also, the location of the cartridge recess 241 is not limited to that shown in Figs. 20 and 21. For example, the cartridge recess 241 can be formed so that it is in contact with the rear surface 245c of the casing 245. That is, one of the lateral surfaces of the cartridge recess 241 can be open on the rear surface 245c side of the casing 245.

Fig. 22 shows a ventilation opening 249 provided in the rear surface 245c (lateral surface opposite the primary surface 245b) of the casing 245. During the game, the motherboard inside the casing 245 generates heat. A blower fan (not shown) is provided near the ventilation opening 249 inside the casing 245. Hot air inside the casing 245 is discharged to the outside from the ventilation opening 249 by the blower fan so as to keep

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the temperature inside the casing 245 within an appropriate range. Protrusions 251 are provided on either side of the ventilation opening 249. Because it is not known where in the game machine 210 the control device 244 will be fastened (for example, the control device 244 may be placed in contact with a wall), the protrusions 251 are provided on either side of the ventilation opening 249 in order to prevent the ventilation opening 249 from being obstructed by a wall. It should be noted that the location, shape, and number of protrusions 251 are not limited to those shown in Fig. 22. The protrusions 251 may take any form, as long as they allow sufficient evacuation of air from the ventilation opening 249.

Figs. 23 and 24 show a modified example of the control device 244. Three cartridge recesses 241a, 241b and 241c are formed in the top surface 245a of the casing 245. A ROM cartridge 264a is inserted (fitted) into the first cartridge recess 241a, an extended I/O cartridge 264b is inserted into the second cartridge recess 241b, and a communications cartridge 264c is inserted into the third cartridge recess 241c. It should be noted that the ROM cartridge 264a can have the same shape as the ROM cartridge 264 of Fig. 20. Like the example shown in Fig. 20, when all the cartridges 264a, 264b and 264c are inserted in the respective recesses, the top surface 245a of the casing 245 is flush with the top surfaces 264d of the cartridges. Connector halves 239a, 239b, and 239c are located in the bottom surfaces of the cartridge recesses 241a, 241b, and 241c, respectively. The connector halves 239a, 239b and

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239c extend out from the motherboard.

In this modification, the three finger recesses 247a, 247b, and 247c are formed. The first and second finger recesses 247a and 247b are recesses into which a service man inserts his fingers when removing the ROM cartridge 264a from the casing 245. When the service man removes the extended cartridge 264b from the casing 245, the service man can for example insert his thumb into the second finger recess 247b and with his remaining fingers grab the opposite side of the extended cartridge 264b. Thus, it is not necessary to provide two finger recesses in the top surface of the casing 245 in order to remove the extended I/O cartridge 264b. Similarly, if the service man removes the communications cartridge 264c from the casing structure 245, the service man can for example insert his thumb into the third finger recess 247c and with his remaining fingers grab the opposite side of the communications cartridge 264c. Thus, it is not necessary to provide two finger insert recesses in the top surface of the casing 245 in order to remove the communications cartridge 264c. It should be noted that using only the first and the second finger recesses 247a and 247b when removing the ROM cartridge 264a is the ideal (typical) case, however, if necessary it is also possible to use the third finger recess 247c as well.

As understood from Figs. 23 and 24, one of the lateral walls (on the primary surface 245b side of the casing 245) of the second cartridge concave 241b is open, and one of the lateral walls (on the rear surface 245c side of the casing 245) of the

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third cartridge concave 241c is also open. Also, the second finger recess 247b formed in a lateral wall of the first cartridge concave 241a is also the finger insert recess formed in a lateral wall of the second cartridge concave 241b. Similarly, the third finger recess 247c that is formed in a separate lateral wall of the first cartridge concave 241a is also the finger insert recess that is formed in a lateral wall of the third cartridge concave 241c. That is, in this embodiment, the first and second cartridge concaves 241a and 241b, which are adjacent, are in communication with one another by the second finger recess 247b, and the first and third cartridge concaves 241a and 241c, which are adjacent, are in communication with one another by the third finger recess 247c.

It should be noted that the number of finger recesses 247 is not limited to three. For example, the number of finger recesses can be four or more taking into account work efficiency and/or manufacturing costs, for example. As one example, it is possible to provide two finger recesses for each cartridge. Also, the location and the shape of the finger recesses are not limited to the example that has been illustrated. For example, an optimal location and shape can be suitably chosen to ease removal of the cartridges. Also, the locations of the cartridge concaves are not limited to the illustrated ones. For example, the first cartridge concave may be in contact with a rear surface 245c of the casing 245. That is, one of the lateral walls of the first cartridge concave 241a can be open on the rear surface 245c side of the casing 245.

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The three cartridges 264a, 264b, and 264c are fit-in modules (circuit modules). The communications cartridge 264c is used for communicating with other game machines. For example, providing the communications cartridge 264c allows the game machine 210 to connect to adjacent game machines via wiring. The extended I/O cartridge 264b is a cartridge for using an I/O not in the basic specifications. For example, providing the extended I/O cartridge 264c allows up to two light-input type gun controllers to be connected. Other configurations are the same as those shown in Figs. 20 to 22, and thus will not be described. It should be noted that what is left after the cartridges 264 (264a, 264b, and 264c) are removed from the control device 244 may be referred to as the motherboard.

To remove the cartridges 264 (264a, 264b, and 264c) from the control device 244, first the plate 220 below the image display screen 216 of the game machine 210 is removed. The plate 220 can be removed by loosing and removing the bolts 221. When the plate 220 is removed, a large opening is formed below the image display screen 216. The service man can reach into the game machine cabinet 214 through the opening and grab and remove the ROM cartridge 264, for example, from the casing structure 245 of the control device 244.

It should be noted that the game machine is not limited to a driving game. For example, the game machine can of course also be a game machine for a character game, a combat game, or a shooting game that uses guns. In such cases, the operation unit 218 would likely include joysticks and push buttons.

WHAT IS CLAIMED IS:

1. A game machine having a main body that is placed on a floor surface, an image display screen provided in an upper portion of the main body, an operation unit that is provided in a mid-height portion of the main body and that receives operation input, and a control device that is provided inside the main body and that carries out game processes, including operations for displaying images on the image display screen, in response to the operation input,

wherein the control device and the operation unit are electrically connected to each other in a detachable manner, and

the control device includes a replaceable game software memory.

2. The game machine according to claim 1, wherein the main body has an opening that is formed below the image display screen, and the opening is closed by a removable member.

3. The game machine according to claim 2, wherein the control device is located behind the removable member.

4. The game machine according to claim 3, wherein the main body has a flat mount at a mid-height portion, and the operation unit is placed on the mount and is detachably attached to the mount.

5. The game machine according to claim 4, wherein the mount is located below the removable member.

6. The game machine according to claim 1, wherein a power switch of the game machine is provided on or near the mount.

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7. The game machine according to claim 6, wherein another power switch of the game machine is provided on a rear surface of the main body.

8. The game machine according to claim 1, wherein a top panel of the operation unit is locked to the operation unit by a lock.

9. The game machine according to claim 8, wherein the top panel has at least one hinge member such that the top panel can pivot to an opened position.

10. The game machine according to claim 6, wherein the power switch provided on or near the mount can be accessed when the top panel of the operation unit is open.

11. The game machine according to claim 1, wherein electrical connection between the control device and the operation unit is disconnected by separating a cable extending from the operation unit from a connector that is attached to the outside of the main body.

12. The game machine according to claim 11, wherein the connector is provided between the mount and the removable member.

13. The game machine according to claim 1, wherein the replaceable game software memory is a ROM cartridge.

14. The game machine according to claim 1 further comprising a seat member attached to the main body.

15. The game machine according to claim 1 further comprising a foot operation unit attached to the main body, such that operations input from the foot operation unit are also

input to the control device.

16. A control device for carrying out game processing, including operations for displaying images on an image display screen, in response to an operation input, the control device being provided inside a main body of a game machine, the game machine having the main body, an image display screen provided in an upper portion of the main body, and an operation unit that is provided in a mid-height portion of the main body and that receives the operation input, the control device comprising:

a display controller for controlling display of the image display screen;

a memory for holding basic operations control software and game processing software;

a central control unit for controlling the display controller while executing the basic operations control software and the game processing software in response to the operation input from the operation unit;

a bus line for electrically connecting the display controller, the memory, and the central control unit to one another; and

a casing that holds a group of connectors for connecting the bus line, the operation unit, and the display screen;

wherein electrical circuits operating as the display controller, the memory, and the central control unit are provided as a plurality of circuit modules,

the casing has a concave in its top surface, and in the bottom portion of the concave there is a first connector half

that is connected to the bus line,

at least one of the circuit modules is a fit-in module that is received in the concave, and the fit-in module has in its bottom portion a second connector half that is detachably engaged with the first connector half, and

a finger recess is formed in a lateral wall surface of the concave.

17. The control device according to claim 16, wherein the fit-in module and the top surface of the casing are flush when the fit-in module is received in the concave of the casing.

18. The control device according to claim 16, wherein the fit-in module is a cartridge-type module.

19. The control device according to claim 16, wherein the casing has a ventilation opening, and protrusions are provided near the ventilation opening.

20. The control device according to claim 19, wherein the protrusions are provided at least on both sides of the ventilation opening.

21. The control device according to claim 16, wherein the group of connectors is provided only in one lateral surface of the casing.

22. The control device according to claim 21, wherein the one lateral surface is provided with not only the group of connectors but also with other connectors and ports for all wiring that is connected to the control device.

23. The control device according to claim 18, wherein the fit-in module is a ROM cartridge, and different game

software can be operated by replacing the ROM cartridge.

24. The control device according to claim 16, wherein at least one lateral wall of the concave is open.

25. The control device according to claim 16 further comprising a finger recess formed in the top surface of the casing, and wherein a plurality of concaves are formed in the top surface of the casing, and two adjacent concaves are in communication with one another through the finger recess.

26. The control device according to claim 16 further comprising a second operation unit attached to a lower portion of the game machine main body.

27. A casing structure for accommodating a control motherboard, comprising:

a casing body having at least one concave in its top surface to receive a cartridge-type component in the concave; and

a finger recess formed in a lateral wall of the concave.

28. The casing structure according to claim 27, wherein the casing has a ventilation opening in a lateral surface, and protrusions are provided adjacent to the ventilation opening.

29. The casing structure according to claim 28, wherein the protrusions are provided at least on both sides of the ventilation opening.

30. The casing structure according to claim 27, wherein at least one lateral wall of the concave is open.

31. The casing structure according to claim 27, wherein a plurality of concaves are formed in the top surface of the

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casing, and two adjacent concaves are in communication with one another through the finger recess.



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Claims searched: 1 at least

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Date of search: 24 June 2003

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Patents Act 1977 : Search Report under Section 17

Documents considered to be relevant:

Category	Relevant to claims	Identity of document and passage or figure of particular relevance	
X	1 to 4, 8, 9, 11, 13	US 4440457	FOGELMAN et al/SEGA ELECTRONICS ...whole document relevant, especially column 4, line 33 to column 5, line 8
Y	1 to 3, 11, 13	GB 2136255A	KNUDSEN....see especially page 2, lines 5 to 8
Y	1, 11 and 12	GB 2112588A	KNUDSEN.... whole document relevant

Categories:

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

Field of Search:

Search of GB, EP, WO & US patent documents classified in the following areas of the UKC⁵:

H1R; H4T

Worldwide search of patent documents classified in the following areas of the IPC⁷:

A63F; H05K

The following online and other databases have been used in the preparation of this search report:

Online: EPODOC JAPIO WPI